ARKA JAIN University
Jharkhand
Estd. Under Jharkhand State Private University Act

Syllabus of

Bachelor of Technology in Mechanical Engineering

Semester-I-II-III-IV-V-VI-VII-VIII

for Batch (2020-24)

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ARKA JAIN University Jharkhand

Syllabus of

B.Tech. in Mechanical Engineering

Semester-I

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes I Lab	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Internship / Industrial Training/Vocational Training (3-4 week)-	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronics Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II – (4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

PROGRAM ARTICULATION MATRIX

SEM	COURSE CODE	PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES															
		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
	Engineering Chemistry-BTE22011	1		1		1	1						1		1		
	Engineering Mathematics–I-BTE21001	2			1		1					1	1	1		1	
	Basic Electrical Engineering-BTE21003	1	1	1	1	1		1	1	1	1				1	1	
	Engineering Mechanics-BTE22009	1		1				1					1				1
	Engineering Chemistry Lab-BTE22015	1			1	1											1
	Basic Electrical Engineering Lab-BTE21005	1	1	1	1		1	1	1	1		1	1	1	1	1	1
	Engineering Mechanics Lab-BTE22013	1		1				1					1				1
I	Engineering Graphics & Design-BTE21004	1				1				1		1		1	1		1
	Engineering Physics-BTE22010	1	2	2	2	1					1		2		1		1
	Engineering Mathematics –II-BTE22008		2	1	1	2			2							1	1
	Programming for Problem Solving-BTE21259	1	1		1			1									
	English for Communication-BTE22370	1	1	1			1				2		1				1
	Constitution of India-BTE25095																
	Engineering physics Lab-BTE21261			2	2	1		1							1	1	1
	Programming for Problem Solving Lab-BTE21262																
II	Workshop Practices-BTE22267	1	1	1	1		1						1				
	Strength of Materials-BTE25289	3	2	1	2									1			2
	Engineering Mathematics –III-BTE23022	3	2	2		1									2		1
	Basic Electronics Engineering-BTE24082	1	3	3	1	2								1	2	2	2
	Material Science-BTE23048	1	3	3	2	1								1	1	1	1
	Thermodynamics-BTE23050	1	3	2	1	1								1	2	2	2
	Environmental Science-BTE24085		1				1	3									1
	Strength of	1	3	2	2	3									2	3	1

III	Materials Lab-BTE23051																
	Basic Electronics Engineering Lab-BTE24087	1	2	3	2	2									2	2	1
	Machine Drawing Lab-BTE23269		2			2								3			2
IV	Applied Thermodynamics-BTE24277	3	3	3													2
	Fluid Mechanics & Machinery-BTE24371	3	3	3	2						1		2			1	2
	Theory Of Machine-BTE24276	2	3	3	2					1	1		2	1	1		2
	Mechanical Measurement and Control-BTE24083	1	2	1	1	2	1			1			1		1	1	2
	Biology for Engineers-BTE23018	1	1				2	2	1	1			1				
	Applied Thermodynamics Lab-BTE24277	2	2	2	2			2		1	1	1	1		2		2
	Fluid Mechanics & Machinery Lab-BTE24372	1	2	3	2					1	1		2	1	2	3	2
	Theory of Machine Lab-BTE24278	2	3	3	2	1							2	1	1		2
	Mechanical Measurement and Control lab-BTE24088	2	3	2	3	3							1	2	1		1
V	Heat & Mass Transfer-BTE25117	3	3	3	3	3							3		3	2	1
	Solid Mechanics-BTE25282	3	3		3								3	2			2
	Manufacturing Processes-I-BTE25283	3	3		3	3							3	3	3	2	3
	Design of Machine Element-BTE25120	3	3	3	3	3								3	3	2	
	Open Elective –I Humanities I-						1	1		1	2	2					2
	Professional Practice, Law & Ethics-BTE25299							2	1	2	2	1			2	1	3
	Essence of Indian knowledge Tradition-BTE25095						2	1			1						1
	Heat & Mass Transfer Lab-BTE25123	3	3	3	3	3							3	2	2	1	2
	Manufacturing Processes Lab-IBTE25284	3	2			3							3	2	3		3
	Design of Machine Element Lab-BTE25374	3	3	3	3										3	3	2
	Internship / Industrial Training/Vocational						1	2		1	3	1	3				1

	Training (3-4 week)-BTE25285																
	Manufacturing Process –II-BTE25119	3	2	3		2	2					2		2	3	2	
	Refrigeration & Air Conditioning-BTE26164	3	3		3		3							2			
	Elective-I Internal Combustion Engines-BTE26300	3			2		3										
	Microprocessors in Automation-BTE26167	3	3	3		3											
	Elective-II Total Quality Management-BTE26375	3					2			2		2				2	2
	Mechatronic Systems-BTE26166	3		2		2											
	Composite Materials-BTE26168	3		2			2								2		
VI	Open Elective –II Humanities II Organizational Behavior-BTE24060									3	3	2	2				2
	Mechanical Software (Solid Works)-BTE25125	2	3	2	2	3								3	2		2
	Manufacturing Process – II Lab-BTE26302	3	2							2					3		2
	Refrigeration & Air Conditioning Lab-BTE26172	3						2		2							3
	Automation in Manufacturing-BTE27320	2	2		2	2	1							2	2		1
	Elective III Computer Aided Design-BTE27376	2		3		2								3			
	Power Plant Engineering-BTE27211	2	2					1									
	Elective-IV Finite Element Analysis-BTE27321	1	2													2	
	Gas Dynamics and Jet Propulsion-BTE27212	2	1	2		2											
	Open Elective- III Sustainable Development-BTE27322						2	3					1				
	Internet of Things-BTE27323	2		2	2	2	2						2				2
	CAD-CAM Lab-BTE27209	1	2	2		3								3			3
	Minor Project-BTE27348																
VII	Summer Internship –II (4-6 Week)-BTE27349																
	Elective V Energy Conservation and Management-BTE28252	3		2	2		3	2						1		1	2
	Process Planning and Cost Estimation-BTE27213	3		2	1	2	3	2				2		1		1	2
	Principles of Management-BTE28377	3		2		3	2	2				2		3		1	2
	Elective VI	3		3		3	3	1				3		2		1	2

VIII	Automobile Engineering-BTE28249																
	Design of Transmission Systems-BTE28250	3	3	2		2				2		3					1
	Open Elective-IV Artificial Intelligent & Machine Learning-BTE28350	3	3	3	2									3	3		
	Cyber Security Laws , Standards & IPR-BTE28351	3	3		2									3	1		
	Open Elective-V Renewable Energy Technologies-BTE28378	3		3		3	3	3				3		3		1	3
	Project Management-BTE28352	3	3	2		3				2		3					1
	Major Project-BTE28364																
	Extra- Curricular/ Co-Curricular Activity-BTE28390																
AVERAGE																	

Subject: Engineering Chemistry

Code: BTE22011

3 Credits | Semester 1

A. Introduction:

Following are the objectives of this course:

- To understand the Concepts of chemical bonding.
- To know the importance of the Periodic Table of the Elements, how it came to be, and its role in organizing chemical information.
- To learn about the basic concepts of Spectroscopy.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] To provide students with the skills required to succeed in graduate school, the chemical industry or professional school.

[CO2] The student will acquire a foundation of chemistry of sufficient breadth and depthto enable them to understand and critically interpret the primary chemical literature.

[CO3] Recognize the exigency and importance of engineering chemistry in the use of industrial and domestic determination.

[CO4] Design economically and new methods of synthesis of new materials and apply their knowledge for protection of environment and application in their field.

[CO5]To provide an insight into latest (R&D oriented) topics, to enable the engineering student upgrade the existing technologies and pursue further research.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

ATOMIC AND MOLECULAR STRUCTURE: Molecular orbital of diatomic molecules and plots of the multicentre orbital. Equations for atomic and molecular orbitals. Energy level diagrams ofdiatomic. Pi-molecular orbital of butadiene and benzene and aromaticity.Crystal field theoryand the energy level diagrams for transition metal ions and their magnetic properties. Numerical based on Crystal field stabilization energy. Bandstructure of solids

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS: Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and itsapplications in medicine. Vibration and rotational spectroscopy of diatomic molecules. Applications.Nuclear magnetic resonance and magnetic resonance imaging, surfacecharacterization techniques. Diffraction and scattering

USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA: Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Cell potentials, the Nernst equation and applications, Relation of free energy with EMF. Acid base, oxidation reduction and solubility equilibrium .Corrosion, Types of corrosion, galvanic series, Cathodic and anodic reactions, corrosion prevention methods.

PERIODIC PROPERTIES: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies ofatoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordinationnumbers and geometries. Hard soft acids and bases (Classification, pearsons HSAB principle, its application and limitation), molecular geometries (VSEPR theory to NH_3, H_3O^+, SF_4, CLF_3,$ICl_2$and H_2O)

INDUSTRIAL CHEMISTRY: Polymers: types of polymer, polymerization, applications, and important synthetic polymers.Ceramics material: Classification and Applications, Water treatment, Air pollution and Control techniques.

E. TEXT BOOKS

T1. A textbook of Engg. Chemistry-ShashiChawla
T2. Engineering Chemistry by Wiley
T3. Physical Chemistry by Atkins
T4. Engineering chemistry by P.C. Jain (Dhantpat Rai Publishing company)
T5. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
T6. Fundamentals of Molecular Spectroscopy, by C. N. Banwell

F. REFERENCE BOOKS

R1. Environmental Engg. - Keiley
R2. Selected topics in inorganic chemistry-MMT
R3. I. A Levine, Physical chemistry, McGraw Hill
R4. Organic chemistry by clayden.
R5.Essentials of Physical chemistry, Bahl& Tuli, S. Chand Publishing.
R6. Inorganic Chemistry by J D Lee.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	To provide students with the skills required to succeed in graduate school, the chemical industry or professional school.	2				1											
[CO2]	The student will acquire a foundation of chemistry of sufficient breadth and depthto enable them to understand and critically interpret the primary chemical literature.		2					1							1		
[CO3]	Recognize the exigency and importance of engineering chemistry in the use of industrial and domestic determination.			2			1								1		
[CO4]	Design economically and new methods of synthesis of new materials and apply their knowledge for protection of environment and application in their field.					2							1				1
[CO5]	To provide an insight into latest (R&D oriented) topics, to enable the engineering student upgrade the existing technologies and pursue further research.				2							1				1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mathematics–I

Code: BTE21001

Credit - 4 | Semester 1

A. Introduction:

- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level
- Serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Remembering differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications, they will have a basic understanding of Beta and Gamma functions

[CO2] Understanding the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems

[CO3] Appling the tool of power series and Fourier series for learning advanced Engineering Mathematics

[CO4] Analyzingthe deal with functions of several variables that is essential in most branches of engineering

[CO5]Evaluating the essential tool of matrices and linear algebra in a comprehensive manner

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

CALCULUS: Evolutes and involutes, Evaluation of definite and improper integrals ,Beta and Gamma functions and their properties Application of definite integral, Curve tracing, area, evaluate surface areas and volumes of revolutions
CALCULUS: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders, Indeterminate forms and Hospitals rule, Maxima and minima

SEQUENCE AND SERIES: Convergence of sequence and series, tests for convergence,Power series, Taylors series, series for exponential, trigonometric and logarithmfunctions,2 Fourier series: Half range sine and cosine series, Parseval's theorem

MULTIVARIABLE CALCULUS (DIFFERENTIATION): Limit, continuity and partial derivatives, directional derivatives, totalderivative, Tangent plane and normal line; Maxima, minima and saddle points, Method of Lagrange multipliers; Gradient, curl and divergence

MATRICES: Symmetric, skew- symmetric and orthogonal matrices, ,complex matrix, hermitian,skewhermitian matrix, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations, Eigen values and Eigen vectors; Diagonalization of matrices, Cayley-Hamilton Theorem, and Orthogonal transformation

E. TEXT BOOKS

T1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,2002

T2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006

F. REFERENCE BOOKS

R1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008

R2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications, they will have a basic understanding of Beta and Gamma functions	**1**										**1**					**1**
[CO2]	The fallouts of Rolle's Theorem that is fundamentalto application of analysis to Engineering problems		**2**			**1**											**1**
[CO3]	The tool of power series and Fourier series for learning advanced Engineering Mathematics			**2**				**1**								**1**	
[CO4]	To deal with functions of several variables that is essential in most branches of engineering								**2**				**1**				
[CO5]	The essential tool of matrices and linear algebra in a comprehensive manner				**1**							**1**		**1**			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Basic Electrical Engineering

Code: BTE21003

Credits- 4 | Semester 1

A. Introduction:

- To Enhancement in understanding the basic concepts of Core Electrical Engineering subjects. The topics covered under this subject will help
- To enhance the basic understanding of Electrical machines and power systems and basic electronics through the topic covered under this Subject

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency

[CO2] Predict the behavior of any electrical and magnetic circuits.

[CO3] Formulate and solve complex AC, DC circuits.

[CO4] Identify the type of electrical machine used for that particular application.

[CO5] Realize the requirement of transformers in transmission and distribution of electric power and other applications.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

A. SYLLABUS

D.C. CIRCUITS : Electrical circuit elements (R, L and C), voltage and current sources, dependent and independent sources, Units and dimensions, Source Conversion, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's theorem and their application for analysis of series and parallel resistive circuits excited by independent voltage sources, Power & Energy in such circuits. Mesh & nodal analysis, Star Delta transformation & circuits and Norton theorems. Time- domain analysis of first-order RL and RC circuits.

A.C. CIRCUITS : Representation and Generation of sinusoidal AC voltage, definition of average value, R.M.S. value, form factor and peak factor of AC quantity , Concept of phasor, Concept of Power factor, Concept of impedance and admittance, Active, reactive and apparent power, Analysis of single-phase ac circuits consisting of R, L, C R-L, R-C, R-L-C series

&parallel circuit Resonance Necessity and advantages of three phase systems, Meaning of Phase sequence, balanced and unbalanced supply and loads. Relationship between line and phase values for balanced star and delta connections. Power in balanced & unbalanced three-phase system and their measurements

TRANSFORMERS : Types of Magnetic Material ,BH characteristics(magnetization characteristics)of Ferro magnetic materials, self - inductance and mutual inductance, energy in linear magnetic systems, AC excitation in magnetic circuits, magnetic field produced by current carrying conductor, Force on a current carrying conductor. Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency Auto-transformer and three-phase transformer connections

ELECTRICAL MACHINES : Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators

POWER CONVERTERS &ELECTRICAL INSTALLATIONS:DC-DC buck and boost converters, duty ratio control Single-phase and three-phase voltage source inverters; sinusoidal modulation Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup

E. TEXT BOOKS

T1. B.L. Theraja & A.K Theraja, Electrical Technology Volume-I, S. Chand & Co

T2.V.N. Mittle, Basic Electrical Engineering, Tata McGraw Hill

T3. S.N. SinghBasic Electrical Engineering , P.H.I

T4. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall

T5.C.L. WadhwaBasic Electrical Engineering, New Age International

T6.Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.

T7.Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

F. REFERENCE BOOKS

R1. L.S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press

R2. E. Hughes, Electrical and Electronics Technology, Pearson

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Understand the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency	**2**	**1**														
[CO2]	Predict the behavior of any electrical and magnetic circuits.			**2**	**3**										**1**		
[CO3]	Formulate and solve complex AC, DC circuits.					**2**		**2**								**1**	
[CO4]	Identify the type of electrical machine used for that particular application.						**2**		**1**								
[CO5]	Realize the requirement of transformers in transmission and distribution of electric power and other applications.									**1**	**2**						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mechanics

Code: BTE22009

Credits- 3 | Semester I

A. Introduction:

- To obtain resultant of various forces
- To obtain resultant of various forces
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

B. Course Outcomes: At the end of the course, students will be able

[CO1] Identify the force systems for given conditions by applying the basics of mechanics.
[CO2] Determine unknown force(s) of different engineering systems.
[CO3] Apply the principles of friction in various conditions for useful purposes.
[CO4] Find the centroid and center of gravity of various components in engineering systems.
[CO5]Select the relevant simple lifting machine(s) for given purposes.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BASICS OF MECHANICS AND FORCE SYSTEM: Basic concepts, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units. Force – unit, representation as a vector and by Bow’s notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon’s Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

EQUILIBRIUM: Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium**,** Lami’s Theorem – statement and explanation, Application for various engineering problems. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple),Beam reaction for cantilever, simply supported beam with or without overhang –

subjected to combination of Point load and uniformly distributed load, Beam reaction graphically for simply supported beam subjected to vertical point loads only

FRICTION & VIRTUAL WORK: Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction.Introduction, laws of coulomb friction, simple contact friction problems, belt friction, the square crew thread rolling resistance, Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Work of a force, Principle of Virtual work and its application.

CENTROID AND CENTRE OF GRAVITY& TRUSS: Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle), Centroid of composite figures composed of not more than three geometrical figures, Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) Centre ofGravity of composite solids composed of not more than two simple solids. The structural model, simple trusses, analysis of simple trusses: method of joints, Method of sections, graphical method.

SIMPLE LIFTING MACHINE: Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility, Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

E. TEXT BOOKS

T1.D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
T2.Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
T3.Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
T4.Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.

F. REFERENCE BOOKS

R1.Dhade, Jamadar &Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
R2. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, CambridgeUniversity Press.
R3. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify the force systems for given conditions by applying the basics of mechanics.	**3**	**3**										**3**				**2**
[CO2]	Determine unknown force(s) of different engineering systems.		**3**										**3**				**3**
[CO3]	Apply the principles of friction in various conditions for useful purposes.		**3**										**3**				**1**
[CO4]	Find the centroid and center of gravity of various components in engineering systems.	**3**			**3**												**2**
[CO5]	Select the relevant simple lifting machine(s) for given purposes.	**3**											**3**				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Chemistry Lab

Code: BTE22015

Credits- 1 | Semester I

A. Introduction:

- To expose the students to a breadth of experimental techniques using modern instrumentation.
- The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.

B. Course Outcomes: At the end of the course, students will be able

[CO1] The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering

[CO2] The students will learn to estimate rate constants of reactions from concentration of reactants/products as a function of time

[CO3] Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiments
1	Determination of surface tension and viscosity.
2	To prepare buffer solution and standardization of pH meter.
3	Determination of chloride content of water.
4	Colligative properties using freezing point depression.
5	Determination of the rate constant of a reaction.
6	Determination of cell constant and conductance of solutions.

7	Chemical analysis of a salt.
8	Lattice structures and packing of spheres.
9	Models of potential energy surfaces.
10	Chemical oscillations- Iodine clock reaction
11	Determination of the amount of iron in an iron ore solution by $KMnO_4$
12	Adsorption of acetic acid by charcoal
13	To determine alkalinity of a given water sample.
14	Synthesis of a polymer/drug.
15	Saponification/acid value of oil.

E. TEXT BOOKS

T1. Practical Chemistry by S.S. Dara

T2.Practical Chemistry by D N Bajpai – S. Chand Publishing

F. REFERENCE BOOKS

R1.Advanced Practical Chemistry Book by pragatiprakashan

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	The chemistry laboratory course will consist of experiments illustrating the principles of Chemistry relevant to the study of science and engineering	**2**													**1**		
[CO2]	The students will learn to an ability to use modern instrumental techniques for engineeringPractice.				**2**											**1**	
[CO3]	The laboratory an ability to choose appropriate materials for various engineering purposes		**2**														
[CO4]	To bring adaptability to new developments in Engineering Chemistry and to acquire the Skills required to become a perfect engineer.					**2**											**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Basic Electrical Engineering Lab

Code: BTE21005

Credits- 1 | Semester I

A. Introduction:

- To impart a basic knowledge of electrical instruments voltmeter, ammeter, multi-meter, and oscilloscope. Real-life resistors, capacitors and inductors. Measurement such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- Emphasize the effects of electric shock and precautionary measures.
- Improve the ability to function on multi-disciplinary team.

B. Course Outcomes: At the end of the course, students will be able

[CO1] Study different meters and instruments for measurement of electrical quantities
[CO2] Study the linear and nonlinear characteristics of different types of loads experimentally
[CO3] Design and experiment potential divider circuits
[CO4] Experimentally verify the basic circuit theorems
[CO5] Measure power and power factor in ac circuits

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiments
1	Introduction to components/Equipments
2	Demonstrate the verification of Ohm’s law.
3	Demonstrate the verification of Resistance in series And parallel apparatus.
4	Demonstrate the verification of Kirchhoff’s current law (KCL).
5	Demonstrate the verification of Kirchhoff’s voltage law (KVL).
6	Demonstrate the verification of superposition theorem.

7	Demonstrate the verification of Thevenin’s theorem.
8	Demonstrate the verification of Norton’s theorem.

E. TEXT BOOKS

T1.D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, latest edition.
T2.S.N. Singh , Basic Electrical Engineering, P.H.I.,2013
T3.Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall,2014
T4.M.S. Sukhija, T. K. Nagsarkar, Basic Electrical and electronics engineering, Oxford University press, 2012

F. REFERENCE BOOKS

R1.C.L. Wadhwa, Basic Electrical Engineering. New Age International.
R2.B.L. Theraja & A.K Theraja Textbook of Electrical Technology - Vol. 1, S. Chand Publication
R3.E. Hughes & I.M. Smith Hughes Electrical Technology Pearson
R4.Vincent Del Toro Electrical Engineering Fundamentals

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Study different meters and instruments for measurement of electrical quantities	**3**	**2**														
[CO2]	Study the linear and nonlinear characteristics of different types of loads experimentally			**2**	**2**												
[CO3]	Design and experiment potential divider circuits			**2**									**1**		**1**	**1**	
[CO4]	Experimentally verify the basic circuit theorems						**1**	**1**									**1**
[CO5]	Select the relevant simple lifting machine(s) for given purposes.	**3**											**3**				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mechanics Lab

Code: BTE22013

Credits- 1 | Semester I

A. Introduction:

- To obtain resultant of various forces.
- To calculate support reactions through conditions of equilibrium for various structures
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

B. Course Outcomes: At the end of the course, students will be able

[CO1] Identify the force systems for given conditions by applying the basics of mechanics.

[CO2] Determine unknown force(s) of different engineering systems.

[CO3] Apply the principles of friction in various conditions for useful purposes.

[CO4] Find the centroid and centre of gravity of various components in engineering systems.

[CO5] Select the relevant simple lifting machine(s) for given purposes.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiments
1	To study various equipment's related to Engineering Mechanics.
2	To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
3	To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
4	Derive Law of machine using Worm and worm wheel.
5	Derive Law of machine using Single purchase crab.

6	Derive Law of machine using double purchase crab.
7	Derive Law of machine using Weston’s differential or wormed geared pulley block.
8	Determine resultant of concurrent force system applying Law of Polygon of forces using forcetable.
9	Determine resultant of concurrent force system graphically.
10	Determine resultant of parallel force system graphically.
11	Verify Lami’s theorem.
12	Study forces in various members of Jib crane.
13	Obtain support reactions of beam using graphical method.
14	Determine coefficient of friction for motion on horizontal and inclined plane.
15	Determine centroid of geometrical plane figures.
16	Determine support reactions for simply supported beam.

E. TEXT BOOKS

T1.Bedi D.S., Engineering Mechanics, Khanna Publishing House
T2.Khurmi, R.S., Applied Mechanics, S.Chand& Co. New Delhi.
T3.Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
T4.Ramamrutham, Engineering Mechanics, S.,S Chand & Co. New Delhi.

F. REFERENCE BOOKS

R1. Dhade, Jamadar &Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
R2. Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, CambridgeUniversityPress.
R3. Meriam, J. L., Kraige, L.G. , Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Identify the force systems for given conditions by applying the basics of mechanics.	**1**															
[CO2]	Determine unknown force(s) of different engineering systems.			**1**													
[CO3]	Apply the principles of friction in various conditions for useful purposes.							**1**									
[CO4]	Find the centroid and center of gravity of various components in engineering systems.												**1**				**1**
[CO5]	Select the relevant simple lifting machine(s) for given purposes.																

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Graphics & Design

Code: BTE21004

Credits- 2 | Semester I

A. Introduction:

- Increase ability to communicate with people
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic Auto Cad skills.
- Learn basic engineering drawing formats
- Prepare the student for future Engineering positions

B. Course Outcomes: At the end of the course, students will be able

[CO1] Perform basic sketching techniques
[CO2] Understandingof architectural and engineering scales will increase.
[CO3] Able to draw orthographic projections and sections.
[CO4] Ability to produce engineered drawings will improve
[CO5] Become familiar with office practice and standards.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

GENERAL INTRODUCTION : Significance of engineering drawing, Introduction to CAD, Lettering, Dimensioning, Scales, Sense of proportioning,Conic sections – General methods only, Different types of projections,

ORTHOGRAPHIC PROJECTIONS OF POINTS AND LINES: Orthographic projections, Projections of points, Projections of lines in different quadrants, traces, inclinations, and true lengths of the lines projections on auxiliary planes. shortest distance, intersecting and non-intersecting lines.

PROJECTIONS OF PLANE FIGURES: Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.

PROJECTION OF SOLIDS &SECTION OF SOLID: Simple cases when solid are placed in different positions Axis faces and tines lying in the faces of the solid making given angles.Sectional orthographic views of geometricalsolids.

DEVELOPMENT OF SURFACE & ISOMETRIC PROJECTION: Development of simple objects with and without sectioning, Concept of Isometric Projection.

E. TEXT BOOKS

T1. Engineering Graphics, N.D Bhatt, Charotar Publishing House Pvt. Limited
T2. Principle of Engineering Graphics And Drawing, R.K Dhawan, S. Chand Publishing
T3. Engineering Graphics And Drafting, P.S GILL,S. K. Kataria& Sons

F. REFERENCE BOOKS

R1. Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. PearsonEducation
R2. Engineering Graphics, Agrawal B. & Agrawal C. M ,TMH Publication
R3. Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah, Scitech Publishers

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	P 11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Perform basic sketching techniques	**1**															
[CO2]	Understandingof architectural and engineering scales will increase.	**1**															
[CO3]	Able to draw orthographic projections and sections											**1**		**2**			
[CO4]	Ability to produce engineered drawings will improve					**1**									**1**		
[CO5]	Become familiar with office practice and standards.									**1**							**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University Jharkhand

Syllabus of

B.Tech. in Mechanical Engineering

Semester-II

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes Lab-I	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Summer Internship –I (3-4 week)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronic Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II – (4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Subject: Engineering Physics

Code: BTE22010

4 Credits | Semester II

A. Introduction:

- To acquire fundamental knowledge about nature and its phenomena including quantitative expression.
- To enhance intellectual, computational, experimental, communication and analytical skills of the students Physics is necessary to satisfy the basic sciences requirement, as appropriate for various engineering disciplines

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify and understand the kinds of experimental results which are incompatible with classical Physics leading to the development of a quantum theory of matter and light.
[CO2] Use basic concepts to analyze and design a wide range of semiconductor devices.
[CO3] Understand & solve different types of wave equations.
[CO4] Use the principles of optics to solve various complex engineering problems.
[CO5]Use fundamental laws and relations to solve problems in electricity, electromagnetism

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
EndSemester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

QUANTUM MECHANICS: Introduction to Quantum Physics, black body radiation , Explanation using the photon concept, Photoelectric effect, Compton effect, Wave particle duality, De-Broglie hypothesis, Heisenberg's Uncertainty principle.Born interpretation for wave function, Free-particle wave function and wave-packets, Time-dependent and time independent Schrodinger equation, particle in a box, Finite Potential barrier and tunneling.

ELECTRONIC MATERIALS AND SEMICONDUTOR: Free electron theory, Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, and Effective mass.Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction,

WAVES AND OSCILLATION: Simple harmonic motion, damped and forced simple harmonic oscillator Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, resonance.

OPTICS AND LASER: Introduction to interference, Analytical treatment of interference, Displacement of fringes, Thin film, Wedge shaped film, Newton's Ring,Concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and diffraction grating, Limit of Resolution, Resolving power of grating,Introduction to interaction of radiation with matter, Stimulated and spontaneous emission, Einstein's coefficient, principles and working of laser: population inversion, pumping, types of laser: He-Ne laser, Ruby laser , application of lasers.

ELECTROMAGNETISM: Electric field and electrostatic potential for a charge distribution; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution. Boundary conditions of electric field and electrostatic potential,Bio-Savart law, vector potential and calculating it for a given magnetic field; the equation for the vector potential and its solution for given current densities. Faraday's law of electromagnetic induction, Equation of continuity, displacement current, Maxwell's equation, Poyting theorem, Electromagnetic waves in free space, conducting and non - conducting medium

E. TEXT BOOKS

T1. Concept of Modern Physics by Arthur Beiser: Publication: TMH
T2.Elements of electro magnetics by Mathew N.O. Sadiku: Publication: Oxford University Press
T3.Introduction to electrodynamics by David J. Griffiths; Pub.: Pearson Education.
T4.Optics by Ajoy Ghatak Pub;TMH
T5.Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.:John Wiley & Sons. Inc. Asian Edition.
T6.P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
T7.Engineering Physics – Hitendra K.Malik & Ajay Kumar Singh by TMH Publication.
T8.The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
T9**.** Introduction to Quantum mechanics, Nikhil Ranjan Roy, 2016, Vikash Publishing House Pvt Ltd

F. REFERENCE BOOKS

R1. Modern Physics by G. Aruldhas & P. Rajagopal; Pub: Prentice Hall of India.
R2. Quantum Physics by H.C. Verma Pub.: Surya Publication .
R3. Lasers and Non-Linear Optics by B.B. Laud; Pub: New Age International (P) Ltd.
R4. Principles of electricity by Leigh Page and Normal llsley Adams, Pub.: Eurasia Publishing House, New Delhi.
R5. Feynmann Lecture Series on Physics
R6. Waves: Berkeley Physics Course, vol.3, Francis Crawford, 2007, Tata McGraw-Hill.
R7. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
R8. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Identify and understand the kinds of experimental results which are incompatible with Classical Physics leading to the development of a quantum theory of matter and light.	2	3										3				
[CO2]	Use basic concepts to analyze and design a wide range of semiconductor devices.			2		3									1		
[CO3]	Understand & solve different types of wave equations.				2								1				2
[CO4]	Use the principles of optics to solve various complex engineering problems.			3	2												
[CO5]	Use fundamental laws and relations to solve problems in electricity, electromagnetism		3								2						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mathematics –II

Code: BTE22008

4 Credits |Semester II

A. Introduction:

- To familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
- To equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines
- To equip the students with standard concepts and tools at an intermediate to advanced level

B. Course Outcomes: At the end of the course,

[CO1] Remembering the mathematical tools needed in evaluating multiple integrals and their usage.
[CO2]Understanding the effective mathematical tools for the solutions of differential equations that model physical processes.
[CO3] Appling the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems
[CO4]Calculate the analytic function**.**
[CO5]Evaluate complex integrals by using Cauchy-Goursat integral theorem.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

MULTIVARIABLE CALCULUS (INTEGRATION): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals,Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity.Triple integrals(Cartesian),orthogonal curvilinear coordinates,Simple applications involving cubes, sphere and rectangular parallelepipeds, Scalar line integrals, vector line integrals, scalar surface integrals,
vector surface integrals, Theorems of Green, Gauss and Stokes

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: solvable for p,solvable for y Equations solvable for x and Clairaut's equation

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation
Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties

COMPLEX VARIABLE – DIFFERENTIATION: Differentiation, Cauchy-Riemann equations, Analytic functions, harmonic functions, finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithm)and their properties, Conformal mappings, Mobius transformations and their properties.

COMPLEX VARIABLE – INTEGRATION: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof),Liouville's theorem and Maximum ,Modulus theorem (without proof)Taylor's series, zeros of analytic functions, singularities, Laurent'sseries; Residues, Cauchy Residue theorem (without proof),Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

E. TEXT BOOKS

T1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.

T2.Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.

F. REFERENCE BOOKS

R1.W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

R2.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Remembering the mathematical tools needed in evaluating multiple integrals and their usage.		2		2												
[CO2]	Understanding the effective mathematical tools for the solutions of differential equations that model physical processes.			1		1											
[CO3]	Appling the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems				2			1								1	
[CO4]	Calculate the analytic function**.**					2											1
[CO5]	Evaluate complex integrals by using Cauchy-Goursat integral theorem.		1														

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Programming for Problem Solving

Code: BTE21259

3 Credits | Semester II

A. Introduction:

- To understand concept of algorithm and programming
- To know various logical components and
- Syntax used in programming
- To learn different ways of transforming a real world problem into system problem

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Formulate simple algorithms for arithmetic and logical problems.
[CO2] Test and execute the programs and correct syntax and logical errors and to implement conditional branching, iteration and recursion
[CO3] To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
[CO4] To use arrays, pointers and structures to formulate algorithms and programs
[CO5] To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
[CO6] To understand various types of files and operations on them

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FUNDAMENTALS OF INFORMATION TECHNOLOGY: Evolution of Computers, Generation and Classification of Computers Application of Computers and etc**.** Memory Hierarchy, RAM, ROM, Types of Secondary Storage Devices and etc.Information, Technology, Role of Information Technology, Information Technology and Internet and etc. **Introduction**, Evolution of Internet, Basic Internet Terms, Getting Connected to Internet, Internet Applications, Data over Internet, Web Browser, Browsing Internet Using Internet Explorer, E-mail, search Engines, Instant Messaging.E-Commerce, Electronic Data Interchange, Smart Cards, Mobile Communication and etc.

C FUNDAMENTALS, DECISION & LOOPING STATEMENTS: The C language. Phases of developing a running computer program in C.Data Concepts in C: Constants, Variables, Expressions, Operators, and operator precedence in C. Different basic data types and their sizes. Managing input and output statements, Sequential control statements. Decision making statements (If-Else constructs). Loop control statements (While construct, Do While construct, For construct).

ARRAYS, STRINGS &FUNCTIONS : One-dimensional Arrays: Declaration and Initialization. String variables, Reading and writing strings, Arithmetic operations on characters, Putting strings together, Comparison of two strings. Functions: The prototype declaration, Function definition.Function call: Passing arguments to a function (by value, by reference). Scope of variables. Recursive function calls, Tail recursion, Tree of recursion. Sorting problems: Selection sort, Insertion sort. Sorting in multidimensional arrays. Sorting in arrays. Search problems: Linear search and binary search. Recursive and iterative formulations.

POINTERS &STRUCTURE : Pointers: Declaring and dereferencing pointer variables. Pointer arithmetic.Accessing arrays through pointers. Pointer types, Pointer and strings. Structures in C: Motivation, examples, declaration, and use. Operations on structures.Passing structures as function arguments. Type defining structures.

LINKED LISTS & FILE HANDLING : Self-referential structures, Dynamic data structures, Linked lists with examples.File operations in C: Input, output, and error streams. Opening, closing, and reading from files. Searching through files using functions such as fseek(), ftell(), and rewind(). Programming for command line arguments.

E. TEXT BOOKS

T1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill .
T2.E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

F. REFERENCE BOOKS

R1.Let us C, Yashwant Kanetkar, BPI publications
R2.Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Formulate simple algorithms for arithmetic and logical problems.	1	1		1			1									
[CO2]	Test and execute the programs and correct syntax and logical errors and to implement conditional branching, iteration and recursion	1	1		1			1									
[CO3]	To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.	1	1		1			1									
[CO4]	To use arrays, pointers and structures to formulate algorithms and programs																
[CO5]	To decompose a problem into functions and synthesize a complete program using divide and conquer approach	1	1		1			1	1								

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

English for Communication

Code: BTE22370

3 Credits | Semester II

A. Introduction:

- To impart basic skills of Communication in English through intensive practice.
- Students of Engineering so as to enable them to enhance their communicative knowledge and soft skills.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Remembering the basic of the comm Represent unication process and to know the practical implementations in the work place.
[CO2] Understanding verbal and non-verbal modes of communication effectively in practical situations
[CO3] Analyzing vocalics and basic grammar.
[CO4] creating competence in reading and writing.
[CO5] Evaluation of speaking process.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

VOCABULARY BUILDING: 'Ancient Architecture in India' from prescribed textbook 'English for Engineers published by Cambridge University. Vocabulary: Synonyms and Antonyms Lexical set of words- Formation of hints with lexical set of words- Usage of Lexical sets in framing meaningful sentences. Standard Abbreviation in English.

IDENTIFYING COMMON ERRORS IN WRITING: Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

SELF DEVELOPMENT AND ASSESSMENT: Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning Self-esteem. Managing Time; Personal memory, Rapid reading,

ORAL COMMUNICATION : Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

NATURE AND STYLE OF SENSIBLE WRITING: Business letters: Enquiry/claim complaint and order. Technical reports, Email writing, Technical articles, Writing reports, Paragraph writing, Techniques for writing precisely. Graphic presentation, Project proposals.

E. TEXT BOOKS

T1. David F. Beer and David Mc Murrey, Guide to writing as an Engineer, John Willey. New York, 2004
T2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
T3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
T4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
T5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
T6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
T7. Xebec, Presentation Book, TMH New Delhi, 2000.
T8 . English for Engineers ,Cambridge university.

F. REFERENCE BOOKS

R1. Practical English Usage. Michael Swan. OUP. 1995.
R2. Remedial English Grammar. F.T. Wood. Macmillan.2007
R3. On Writing Well. William Zinsser. Harper Resource Book. 2001
R4. AICTE Modal

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Remembering the basic of the comm - unication process and to know the practical implementations in the work place.	2								2							
[CO2]	Understanding verbal and non-verbal modes of communication effectively in practical situations						2			2							
[CO3]	Analyzing vocalic and basic grammar		2														2
[CO4]	creating competence in reading and writing			2									2				
[CO5]	Evaluation of speaking process.						2				3						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Constitution of India

Code: BTE25095

0 Credits | Semester II

A. Introduction:

- The objective of the Constitution of India is to establish a society where there is: Justice - social, economic and political. Liberty - thought, expression, faith, belief and worship

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNION GOVERNMENT AND ITS ADMINISTRATION: Structure of the Indian Union: Federalism Centre- State relationship President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat Lok Sabha, Rajya Sabha

STATE GOVERNMENT AND ITS ADMINISTRATION: Governor: Role and Position, CM and Council of ministers State Secretariat: Organization, Structure and Functions.

LOCAL ADMINISTRATION: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal CorporationPachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

ELECTION COMMISSION: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

E. TEXT BOOKS

T1. Indian Polity' by Laxmikanth
T2. 'Indian Administration' by Subhash Kashyap

F. REFERENCE BOOKS

R1. 'Indian Constitution' by D.D. Basu
R2. 'Indian Administration' by Avasti and Avasti

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	**STATEMENT** .	**CORRELATION WITH PROGRAM OUTCOMES**												**CORRELATION WITH PROGRAM SPECIFIC OUTCOMES**			
		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**
[CO1]	Understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context work place												1				

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Physics Lab

Code: BTE21261

1 Credits | Semester II

A. Introduction:

- To study the use of physical principles and analysis in various fields of engineering and technology.
- To supplement the theoretical knowledge gained in the lecture by hands-on experience with the equipment. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.
- Demonstrate an ability to make physical measurements & understand the limits of precision measurement.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand calculation of specific resistance of wire by Carey Foster bridge
[CO2] Calculate thermal conductivity of poor conductors
[CO3] Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current
[CO4] Study the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.
[CO5] Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Internal Examination(Assessment)	05
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

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D. SYLLABUS

Sl. No.	**Name of Experiments**
1.	To determine the specific resistance of the material of a wire by Carey Foster bridge
2.	To determine the Planck's constant using LED.
3.	To determine the wavelength of sodium light by using Newton's ring apparatus.
4.	To find the wave length of sodium light using Fresnel's biprism
5.	To determine dispersive power of the material of the prism with the help of a Spectrometer

6.	To determine the number of lines per centimeter of the plane diffraction grating by using sodium light.
7.	To determine the thermal conductivity of following bad conductor (a) ebonite (b) mica sheet (c) wooden By Lee's disc method
8.	To determine the co-efficient of viscosity of glycerin by Stoke's method.
9.	To determine acceleration due to gravity by a Bar Pendulum.
10.	To determine input & output characteristics of a PNP Junction Transistor in CE and CB configuration.
11.	To determine input & output characteristics of a NPN Junction Transistor in CE and CB configuration
12.	To study resonance phenomena in LCR circuits with AC current
13.	To measure moment of inertia of Flywheel
14.	To determine the Lorentz force in a vacuum tube.
15.	To measure the numerical aperture of an optical fiber.
16.	To obtain the particle size by Laser
17.	To obtain forbidden energy gap of Semiconductor Diode.
18.	To obtain Dielectric constant.
19.	To obtain Curie temperature
20.	To determine the time constant of an RC circuit.

E. Text Book:

T1. A Text Book of Engineering Physics Practical by Dr. Ruby Das, C.S. Robinson, Dr. Rajesh Kumar & Prashant Kumar Sahu; Pub University Science Press

T2.Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.:John Wiley & Sons. Inc. Asian Edition.

F. Reference Books:

R1. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers.

R2. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.

G.Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Understand calculation of specific resistance of wire by Carey Foster bridge	3															3
[CO2]	Calculate thermal conductivity of poor conductors			1	2												
[CO3]	Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current					3										1	
[CO4]	Study the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.				3												
[CO5]	Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light.			3				1							3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Programming for Problem Solving Lab

Code: BTE21262

Credits- 2 | Semester II

A. Introduction:

- To work with an IDE to create, edit, compile, run and debug programs
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.

B. Course Outcomes: At the end of the course, students will be able

[CO1] To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).To test and execute the programs and correct syntax and logical errors.

[CO2] To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

[CO3] To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Internal Examination(Assessment)	05
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiments**
1	a) Write a C program to find sum and average of three numbers. b) Write a C program to find the sum of individual digits of a given positive integer
2	a) Write a C program to generate the first n terms of the Fibonacci sequence b) Write a C program to generate prime numbers between 1 to n. c) Write a C program to check if the given number is Armstrong or not

3	a) Write a C program to check whether the given number is perfect or not b) Write a C program to check whether the given number is strong or not.
4	a) Write a C program to find the roots of a quadratic equation. b) Write a C program perform arithmetic operations using switch statement.
5	a) Write a C program to find factorial of a given integer using non-recursive function b) Write a C program to find factorial of a given integer using recursive function
6	a) Write C program to find GCD of two integers by using recursive function. b) Write C program to find GCD of two integers by using non-recursive function
7	a) Write a C program to find the largest and smallest number in a list of integers. b) Write a C program to Sort the Array in an Ascending Order. c) Write a C program to find whether the given matrix is symmetric or not.
8	a) Write a C program to perform addition of two matrices. b) Write a C program using function to perform multiplication of two matrices.
9	a) Write a C program to use function to insert a sub-string in to given main string from a given position. b)Write a C program to swap the values of two variables using (i) Call by value (ii) Call by reference
10	a) Write a C program using user-defined functions to determine whether the given string is palindrome or not. b) Write a C program that displays the position or index in the main string S where the sub string T begins, or - 1 if S doesn't contain T
11	a) Write C program to count the number of lines, words and characters in a given text. b) Write a C program to find the sum of integer array elements using pointers
12	a) Write a C Program to Calculate Total and Percentage marks of a student using structure

E. TEXT BOOKS

T1. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
T2.Computer programming in C.V.RAjaraman, PHI Publishers.
T3.C Programming, E.Balagurusamy, 3rd edition, TMHPublishers.

F. REFERENCE BOOKS

R1. C Programming, M.V.S.S.N Venkateswarlu and E.V.Prasad,S.Chand Publishers.
R2. Mastering C,K.R.Venugopal and S.R.Prasad, TMH Publishers.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language). To test and execute the programs and correct syntax and logical errors.	2	3														
[CO2]	To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.			2	2												
[CO3]	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.					1											

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Workshop Practice

Code: BTE22267

2 Credits | Semester II

A. Introduction:

- To understand basic engineering processes for manufacturing and assembly
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment's
- To understand and interpret job drawings, produce jobs, and inspect the job for specified dimension.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines
[CO2] Understand job drawing and complete jobs as per specifications in allotted time
[CO3] Inspect the job for the desired dimensions and shape
[CO4] Operate, control different machines and equipment's adopting safety practices

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Internal Examination(Assessment)	05
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FITTING SHOP: Introduction Of Workshop Tools & Measuring Instrument Fitting: - Demonstration of different fitting tools, safety practice and general guidelines. Cutting and Filing. Filing, Measurement and Finishing etc Practice: T-fitting , V-Fitting etc

CARPENTRY SHOP: Demonstration of power tools and equipment for carpentry, safety practices and general guidelines. Carpentry: Demonstration of different wood working tools / machines. Demonstration of Different Wood Working Processes Like Plaining Marking ,Chiseling ,Grooving ,Turning of Wood etc Practice: - T-Lap joint, Dovetail joint etc

WELDING SHOP: Demonstration of tools and equipment for welding, safety practices and general guidelines.Demonstration of different welding tools / machines. Demonstration on Arc Welding, Gas

Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding Practice : Butt , lap joint etc.

PLUMBING SHOP: Demonstration – plumbing tools, symbols and joints. Joining GI pipes by threading, PVC pipes by gluing and cementing Practice :- To Make Internal & External Thread

MACHINE SHOP: Demonstration of tools and equipment for Machine, safety practices and general guidelines. Demonstration of all machine like Lathe Machine, Drill machine, Milling Machine, Shaper machine etc. Practice :- To make Step Turning , Tapper Turning, Turning, Facing etc.

E. TEXT BOOKS

T1. Workshop Technology Vol-I,II,III Hajra Choudry., Media Promotors and Publishers P Ltd.
T2.Manufacturing Technology vol 1 by P.N. Rao Mc.Grow Hill.

F. REFERENCE BOOKS

R1. Workshop technology by R.S. Raghuwanshi.Dhanpat Ray & co
R2. Workshop technology by R.S. Khurmi&J.K.Gupta S.Chand co.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CO1]	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines	**2**								**2**							
[CO2]	Understand job drawing and complete jobs as per specifications in allotted time						**2**			**2**							
[CO3]	Inspect the job for the desired dimensions and shape		**2**														**2**
[CO4]	Operate, control different machines and equipment's adopting safety practices			**2**									**2**				

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University
Jharkhand

Syllabus of
B.Tech. in Mechanical Engineering
Semester-III

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes Lab-I	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Summer Internship –I (3-4 week)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronic Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II – (4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Subject: Strength of Materials

Code: BTE25289

4 Credits | Semester III

A. Introduction:

- To understand the concept of Simple Stresses and Strains.
- To understand the concept of Strain Energy.
- To understand the concept of Shear Force and Bending Moment Diagrams.
- To understand the concept of Theory of Simple Bending and Deflection of Beams.
- To understand the concept of Torsion in Shafts and springs.
- To understand the concept of Thin Cylindrical Shells.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Remember the definition of stress and strain. Find the changes in axial, lateral and volumetric dimensions

[CO2] Understand the phenomenon of shear force and bending moment and draw the S.F. & B.M diagrams of for UDL and Point loads.

[CO3] Apply various approaches to calculate thermal stresses, in bodies of uniform section and composite sections. Obtain expressions for instantaneous stress developed in bodies subjected to different loads.

[CO4] Analyze the theory of bending and deflection of beam.

[CO5] Evaluate and Compare strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

SIMPLE STRESSES AND STRAINS: Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress – strain diagram for M.S. and C.I. specimens,Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite,Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/shock load; Related numerical problems

SHEAR FORCE & BENDING MOMENT DIAGRAMS: Types of beams, Types of Loads , Definition and explanation of shear force and bending moment**,**S.F and B.M. diagrams by the analytical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Over hanging beam with point loads, at the centre and at free ends, f) Over hanging beam with UDL throughout, g) Combination of point and UDL for the above; Related numerical problems,

THEORY OF SIMPLE BENDING AND DEFLECTION OF BEAMS: Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending,Bending Equation $M/I = \sigma/Y = E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross- section; Definition and explanation of deflection as applied to beams,Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems,

TORSION IN SHAFTS AND SPRINGS: Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion,Derivation of the equation $T/J=fs/R=G\theta/L$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts,Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation),stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.

THIN CYLINDRICAL SHELLS: Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell, Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.

E. TEXT BOOKS

T1. Strength of Materials, R. S. Khurmi,, S. Chand & Co., Ram Nagar, New Delhi – 2002
T2. Strength of Materials, D.S. Bedi, Khanna Book Publishing Co., Delhi
T3. Strength of Materials, S. Ramamrutham, 15 thEdn 2004, Dhanpat Rai Pub. Co., New Delhi.

F. REFERENCE BOOKS

R1. Strength of Materials,R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
R2. Strength of Materials, S. S. Rattan, Tata Mcgraw hill, New Delhi, 2008, ISBN 9780070668959

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PSO 4
[CO1]	Remember the definition of stress and strain. Find the changes in axial, lateral and volumetric dimensions	**2**	**2**														**1**
[CO2]	**[CO2]** Understand the phenomenon of shear force and bending moment and draw the S.F. & B.M diagrams of for UDL and Point loads.	**3**	**2**	**1**	**2**												**3**
[CO3]	**[CO3]** Apply various approaches to calculate thermal stresses, in bodies of uniform section and composite sections. Obtain expressions for instantaneous stress developed in bodies subjected to different loads.	**3**	**2**	**1**	**1**												**2**
[CO4]	**[CO4]** Analyze the theory of bending and deflection of beam.		**2**														**2**
[CO5]	**[CO5]** Evaluate and Compare strength and weight of solid and		**2**	**1**	**2**									**1**			**2**

	hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.																

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Engineering Mathematics III

Code: BTE23022

4 Credits | Semester III

A. Introduction:

- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- To Equip students with the concepts of partial differential equations and how to solve linear partial differential equations with different methods.
- To provide an overview of probability and statistics to engineers.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the concept of partial differential equations, theory of probability and its applications on engineering problems, theory of data distribution, standard deviation and different charts.

[CO2] Apply concept of differential equation, concept of statics in data sampling for solving general engineering problems.

[CO3] Analyze the process of partial differentiation, probability, statically formulation and data sampling.

[CO4] Evaluate the result of the partial differentiation and its applications, probability, statics and sampling of data.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

PARTIAL DIFFERENTIAL EQUATION: Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs**,** Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

APPLICATION OF DIFFERENTIAL EQUATION: Second-order linear equations and their classification, Initial and boundary conditions, D' Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation,Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates,solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

PROBABILITY THEORY: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality,Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule

STATISTICS: Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions,Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves

SAMPLING OF DATA: Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean.Difference of means, and difference of standard deviations. Test for ratio of variances - Chi- square test for goodness of fit and independence of attributes

E. TEXT BOOKS

T1.Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
T2.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
T3..B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

F.REFERENCE BOOKS

R1.P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
R2.S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3	PS O 4
[CO1]	Understand the concept of partial differential equations, theory of probability and its applications on engineering problems, theory of data distribution, standard deviation and different charts.	2	2	1													1
[CO2]	Apply concept of differential equation, concept of statics in data sampling for solving general engineering problems.	3	1	2		1									2		1
[CO3]	Analyze the process of partial differentiation, probability, statically formulation and data sampling.	3	1												1		
[CO4]	Evaluate the result of the partial differentiation and its applications, probability, statics and sampling of data.	2	2														
[CO5]	.																

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Basic Electronics Engineering

Code: BTE24082

3 Credits | Semester III

A. Introduction:

- To provide an overview of electronic device components to Mechanical engineering students.
- To brief about Operational amplifiers and its applications in engineering systems.
- To learn concept of timing circuits and oscillators used in electronic devices.
- To provide basics of digital electronics and its application in engineering.
- To give basics of electronic communication systems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the principles of semiconductor devices and their applications.

[CO2] Design an application using Operational amplifier

[CO3] Apply the use of timing circuits and oscillators.

[CO4] Analyze the analog and digital signals using logic gates, flip-flop as a building block of digital systems.

[CO5] Learn the basics of Electronic communication system.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

SEMICONDUCTOR DEVICES AND APPLICATIONS: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter,Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series,Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

OPERATIONAL AMPLIFIER AND ITS APPLICATIONS: Introduction to operational amplifiers, Op-amp input modes and parameters,Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741,Inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator,

TIMING CIRCUITS AND OSCILLATORS: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback,Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator,

DIGITAL ELECTRONICS FUNDAMENTALS: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions**,**simplification using Kmap, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Logic,Block diagram of microprocessor/microcontroller and their applications.

ELECTRONIC COMMUNICATION SYSTEMS: Elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemesMobile communication systems: cellular concept and block diagram of GSM system.

E. TEXT BOOKS

T1.Floyd,” Electronic Devices” Pearson Education 9th edition, 2012.
T2.R.P. Jain , “Modern Digital Electronics”, Tata Mc Graw Hill, 3rd Edition, 2007. .

F. REFERENCE BOOKS

R1. Frenzel, “Communication Electronics: Principles and Applications”, Tata Mc Graw Hill, 3rd Edition, 2001

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	**STATEMENT**	**CORRELATION WITH PROGRAM OUTCOMES**												**CORRELATION WITH PROGRAM SPECIFIC OUTCOMES**			
		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**
[CO1]	Understand the principles of semiconductor devices and their applications.	**1**	**2**		**1**	**1**											**1**
[CO2]	Design an application using Operational amplifier		**3**	**3**										**1**			**2**
[CO3]	Apply the use of timing circuits and oscillators.		**3**			**2**								**1**		**2**	**2**
[CO4]	Analyze the analog and digital signals using logic gates, flip-flop as a building block of digital systems.	**1**		**2**											**2**	**2**	**2**
[CO5]	Learn the basics of Electronic communication system.	**1**															**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Material Science

Code: BTE23048

3 Credits | Semester III

A. INTRODUCTION:

- To understand crystal structures and atomic bonds.
- To understand the properties of different types of ferrous metals and alloys.
- To understandthe properties of different types of non-ferrous metals and alloys.
- To understand various metallic failures and acquire the knowledge of testing of materials.
- To understand the concept of corrosion and its prevention.

B. COURSE OUTCOMES: By the end of this course, students will be able to:

[CO1] Understand the crystal structures and atomic bonds. Classification of ferrous metals and their properties

[CO2] Describe non-ferrous metals, cutting tool materials and composites along with their properties. Principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

[CO3] Apply various parameters to understand the properties and compositions of materials.

[CO4] Analyze the various phase diagrams of ferrous metals and alloys, composition and use of non-ferrous metals.

[CO5] Evaluate different methods of failure analysis and testing of materials.

C. ASSESSMENT PLAN:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

CRYSTAL STRUCTURES AND BONDS: Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP,Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP,Simple problems on finding number of atoms for a unit cell.Bonds in solids**:** Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.

PHASE DIAGRAMS, FERROUS METALS AND ITS ALLOYS: Isomorphs, eutectic and eutectoid systems, Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI,Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses
.

NON-FERROUS METALS AND ITS ALLOYS: Properties and uses of aluminium, copper, tin, lead, zinc, magnesium and nickel,Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminum alloys: Duralumin, hindalium, magnelium – composition, properties and uses; Nickel alloys: Inconel, monelnicPerome – composition, properties and uses.Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.

FAILURE ANALYSIS & TESTING OF MATERIALS: Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity. fatigue; endurance limit; characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture.Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test.Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.

CORROSION & SURFACE ENGINEERING: Nature of corrosion and its causes; Electrochemical reactions, Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions; Types of corrosion; Corrosion control: Material selection, environment control and design.Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating,Electro polishing and photo- etching ;– Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards.

E. TEXT BOOK

T1.A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi. 2003.

T2.RMaterial Science & Engineering – R.K. Rajput, S.K. Kataria& Sons, New Delhi, 2004.

F. REFERENCES

R1. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.

R2. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Understand the crystal structures and atomic bonds. Classification of ferrous metals and their properties	**1**	**2**											**1**			**1**
[CO2]	Describe non-ferrous metals, cutting tool materials and composites along with their properties. Principle of corrosion, their types and its prevention methods along with the various surface engineering processes.	**1**	**3**	**3**	**2**	**1**									**1**	**1**	**1**
[CO3]	Apply various parameters to understand the properties and compositions of materials.	**1**	**2**	**2**													**1**
[CO4]	Analyze the various phase diagrams of ferrous metals and alloys, composition and use of non-ferrous metals.		**1**		**2**											**1**	**1**
[CO5]	Evaluate different methods of failure analysis and testing of materials.	**2**														**1**	**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Thermodynamics

Code: BTE23050

4 Credits | Semester III

A. INTRODUCTION:

- To learn about work and heat interactions, and balance of energy between system and its surroundings.
- To learn about application of I law to various energy conversion devices.
- To evaluate the changes in properties of substances in various processes.
- To understand the difference between high grade and low grade energies and II law limitations on energy conversion.

B. COURSE OUTCOMES: By the end of this course, students will be:

[CO1] Understand the concept of system and surroundings, energy balance involving heat and work interactions.
[CO2] Describe about the temperature scales and laws of thermodynamics.
[CO3] Apply the various forms of measurements involved in thermodynamic processes.
[CO4] Analyze the thermodynamic cyclic processes.
[CO5]Evaluate the changes in thermodynamic properties of substances & performance of energy conversion devices

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

FUNDAMENTALS: System & Control volume; Property, State & Process; Exact & Inexact differentials.Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems,First Law forCyclic& Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

DEFINITION OF PURE SUBSTANCE: Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water. Definitions of saturated states; P-v-T surface; Use of steam tables and R134atables, Saturation tables; superheated tables Identification of states & determination of properties,Mollier's chart.

FIRST LAW FOR FLOW PROCESSES: Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling. Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume,

SECOND LAW OF THERMODYNAMICS: Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale,Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property, Principle of increase of entropy; Illustration of processes in Tscoordinates,Definition of Isentropic efficiency for compressors, turbines and nozzles-Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work, Second law analysis for a control volume. Energy balance equation and Energy analysis.

THERMODYNAMIC CYCLES: Basic Rankine cycle; Basic Brayton cycle,Basic vapor compression cycle and comparison with Carnot cycle.

E. TEXT BOOK

T1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
T2.Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India.

F. REFERENCES

R1. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
R2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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	PS O 2	PS O 3	PS O 4
[CO1]	Understand the concept of system and surroundings, energy balance involving heat and work interactions.	**1**	**1**														**1**
[CO2]	Describe about the temperature scales and laws of thermodynamics.	**1**	**3**	**2**		**1**								**1**	**2**		**2**
[CO3]	Apply the various forms of measurements involved in thermodynamic processes.	**1**	**2**	**2**	**1**										**2**	**2**	**2**
[CO4]	Analyze the thermodynamic cyclic processes.		**1**			**1**									**2**	**2**	**2**
[CO5]	Evaluate the changes in thermodynamic properties of substances & performance of energy conversion devices	**1**		**1**													**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Environmental Science

Code: BTE24085
0 Credits | Semester III

A. INTRODUCTION:

- Solve various engineering problems applying ecosystem to produce eco – friendly products.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrial applications.
- Solve local solid and e-waste problems.

B. COURSE OUTCOMES: By the end of this course, students will be:

[CO1] Understand the importance of environment and stability of ecosystem.
[CO2] Describe Ecosystem, pollutions and their controls.
[CO3] Apply the sources of energy to make the environment eco friendly and to make life for sustainability.
[CO4] Analyze the solid waste management and environmental management policy and Acts.
[CO5] Evaluate the use of parameters involved in environmental pollution controls, use of energy resource management etc.

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

INTRODUCTION TO ENVIRONMENTAL SCIENCE: Definition, Principles and scope of Environmental Science,Earth, Man and Environment. Ecosystems, Pathways in Ecosystems.Physico-chemical and Biological factors in the Environment.Geographical classification and zones'.

AIR AND NOISE POLLUTION: Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler), Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator) Gaseous Pollution Control: Absorber, Catalytic Converter,Effects of air pollution due to Refrigerants, I.C., Boiler

Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000

WATER AND SOIL POLLUTION: Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation**,**Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

RENEWABLE SOURCES OF ENERGY: Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas,Wind energy: status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy,New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin andpower plants of geothermal energy.

SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT: Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries,Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste Air quality act 2004, air pollution control act 1981, water pollution, and control act1996.Structure and role of Central and state pollution control board. Concept of Carbon Credit, Carbon Footprint. Environmental management in fabrication industry. ISO14000: Implementation in industries, Benefits.

E. TEXT BOOK

T1. S.C. Sharma & M.P. Poonia, Environmental Studies,Khanna Publishing House,NewDelhi
T2.C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
T3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and
T4. Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099.

F. REFERENCES

R1. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
R2. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication,2007, ISBN: 81-224-1835-X.
R3. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07-451871-8.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Understand the importance of environment and stability of ecosystem.							**3**									
[CO2]	Describe Ecosystem, pollutions and their controls.		**1**				**1**	**3**									
[CO3]	Apply the sources of energy to make the environment ecofriendly and to make life for sustainability.		**1**					**3**									**1**
[CO4]	Analyze the solid waste management and environmental management policy and Acts.		**1**				**1**	**3**									
[CO5]	Evaluate the use of parameters involved in environmental pollution controls, use of energy resource management etc.						**1**	**3**									

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Strength of Materials Lab

Code: BTE23051

1 Credits | Semester III

A. Introduction:

- The objective of the course is to make the student understand the behavior of materials under different types of loading for different types structures.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Conduct tension test on Materials like steel etc.
[CO2] Conduct compression tests on spring, etc.
[CO3] Determine hardness of metals.
[CO4] Determine the strength of materials by different test.
[CO5] Conduct the torsion test to find modulus of rigidity.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

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D. SYLLABUS

S.No.	Name of Experiment
1	To Study the various component parts of the Universal Testing Machine (U.T.M.) & test procedures of various practical's to be performed.
2	To conduct a tensile test on a mild steel specimen and determine the following: Limit of proportionality, Elastic limit, Yield strength, Ultimate strength, Young's modulus of elasticity, Percentage elongation, Percentage reduction in area
3	To conduct hardness test on mild steel, carbon steel, brass and aluminum specimens
4	To conduct torsion test on mild steel or cast iron specimens to find out modulus of rigidity.

5	To determine the impact strength of steel by Izod impact test.
6	To determine the impact strength of steel by (Charpy test).
7	To determined young's modulus of elasticity of material of beam simply supported at ends.
8	To determined Shear Test of Steel.
9	Spring Testing

E. TEXT BOOK

T1. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi. 2003.

T2.RMaterial Science & Engineering – R.K. Rajput, S.K. Kataria& Sons, New Delhi, 2004.

F. REFERENCES

R1. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.

R2. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Conduct tension test on Materials like steel etc.	**1**		**2**	**2**	**3**									**2**	**3**	**1**
[CO2]	Conduct compression tests on spring, etc.		**2**	**2**	**2**	**3**									**2**	**3**	**1**
[CO3]	Determine hardness of metals.		**3**	**2**	**2**	**3**									**2**	**3**	**1**
[CO4]	Determine the strength of materials by different test.		**2**	**2**	**2**	**3**									**2**	**3**	**1**
[CO5]	Conduct the torsion test to find modulus of rigidity.		**2**	**2**	**2**	**3**									**2**	**3**	**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Basic Electronics Engineering Lab

Code: BTE24087

1 Credits | Semester III

A. Introduction:

- To provide students engineering skills by way of breadboard circuit design with electronic devices and components.
- To design and analyze various Electronic circuits such as multivibrators, applications of operational amplifiers, RC coupled amplifiers, oscillators, digital circuits etc. So that students are able to understand the practical aspects of basic electronics theory.
- To enable the students to simulate and test the Analog, Digital and mixed Electronics circuits using Or CAD software.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.
[CO2] Two Terminal Element Relationships for inductors, capacitors, and analysis ofmagnetic circuits.
[CO3] To acquire the knowledge about the characteristics and working principles of Semiconductor diodes, Bipolar Junction Transistor
[CO4] To get an insight about the basic introduction of Digital electronics.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	Familiarization with passive and active electronic components such as Resistor, Inductor, Capacitor, Diode, Transistor (BJT) etc.
2	Familiarization with equipment like DC power supply, multimeter, CRO, Function generator etc.

3	Study of V-I characteristics of Junction diode.
4	Study of V-I characteristics of Zener diodes.
5	Study of Half wave rectifier with regulation efficiency and ripple factor.
6	Study of Bridge rectifier with regulation efficiency and ripple factor.
7	Study of input characteristics and output characteristics of BJT in CE configuration.
8	Study of Logic Gates and realization of Boolean functions using Logic Gates.

E. TEXT BOOKS

T1. Floyd," Electronic Devices" Pearson Education 9th edition, 2012.

T2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007. .

F. REFERENCE BOOKS

R1. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.	**1**															**1**
[CO2]	Two Terminal Element Relationships for inductors, capacitors, and analysis ofmagnetic circuits.		**2**	**3**	**2**	**2**									**2**	**2**	**1**
[CO3]	To acquire the knowledge about the characteristics and working principles of		**2**	**3**	**2**	**2**									**2**	**2**	**1**
[CO4]	Semiconductor diodes, Bipolar Junction Transistor	**1**															**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Machine Drawing Lab

Code: BTE23269

2 Credits | Semester III

A. Introduction:

- Comprehend and draw the picture of construction.
- Comprehend and draw the pictures of assembling

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Understand the types of thread & their uses.
[CO2] Draw different types of joints with specific dimensions.
[CO3] Draw different types of coupling with their use.
[CO4] Understand the use of bearing and pulleys with their drawing.
[CO5] Draw assembly of mechanical devices.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

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D. SYLLABUS

S.No.	**Name of Experiment**
1	Draw the various types of threads (v-thread, Square thread).
2	Riveting, Forms and proportions of rivet-heads, Types of riveted joints- Lap joint, Butt Joint.
3	Keys - Taper Keys, sunk taper key, saddle keys, Round key or pin key, Taper pin, Gib-head. Cotter and cotter joints- Socket and spigot joint, sleeve joint, strap joint. knuckle joints

4	Coupling - Universal coupling and Oldham coupling.
5	Bearings Plummer Block (Assembled Drawing) Foot step Bearing (Assembled Drawing)
6	Pulleys- Fast and loose pulley (Assembled Drawing)
7	Mechanical Screw Jack (Assembly)
8	Drilling Jig (Assembly)
9	Connecting Rod (Assembly)

E. Text Book:

1. A textbook of machine drawing, P S Gill, Katson Publication.
2. Machine Drawing , N D Bhatt

F. Reference Books:

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PSO 4
[CO1]	Understand the types of thread & their uses.		**2**											**2**			
[CO2]	Draw different types of joints with specific dimensions.		**2**			**2**								**3**			**2**
[CO3]	Draw different types of coupling with their use.		**2**			**2**								**3**			**2**
[CO4]	Undersand the use ofbearin andpulleywiththeir drawing.		**2**											**3**			**2**
[CO5]	Draw Assembly Of mechanical devices.		**2**			**2**								**3**			**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University Jharkhand

Syllabus of

B.Tech. in Mechanical Engineering

Semester-IV

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes Lab-I	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Summer Internship –I (3-4 week)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronic Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II –(4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:

AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Subject: Applied Thermodynamics

Code: BTE24277

4 Credits | Semester IV

A. Introduction:

- To learn about of 1st law for reacting systems and heating value of fuels
- To learn about gas and vapor cycles and their first law and second law efficiencies
- To understand about the properties of dry and wet air and the principles of psychometric
- To learn about gas dynamics of air flow and steam through nozzles
- To learn the about reciprocating compressors with and without inter cooling
- To analyze the performance of steam turbines

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand phenomena occurring in high speed compressible flows.

[CO2] Apply various practical power cycles and heat pump cycles.

[CO3] Analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors

[CO4] Evaluate the air quality after humidification or dehumidification using psychometric chart.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Introduction to solid, liquid and gaseous fuels– Stoichiometry exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.

VAPOR POWER: Vapor power cycles Rankine cycle with superheat, reheat and regeneration, energy analysis. Super- critical and ultra-super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and inter cooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.

PROPERTIES OF DRY AND WET AIR: Properties of dry and wet air, use of pschyrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

BASICS OF COMPRESSIBLE FLOW: Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation - compressible flow in diffusers, efficiency of nozzle and diffuser.

RECIPROCATING COMPRESSORS: Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. Analysis of steam turbines, velocity and pressure compounding of steam turbines.

E. TEXT BOOKS

T1.Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

T2.Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

F. REFERENCE BOOKS

R1.Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

R2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand phenomena occurring in high speed compressible flows.	3	2		2												2
[CO2]	Apply various practical power cycles and heat pump cycles.	2	3										1				2
[CO3]	Analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors	3	2	3	3												2
[CO4]	Evaluate the air quality after humidification or dehumidification using psychometric chart.	2	2	3	3								1				1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Fluid Mechanics& Machinery

Code: BTE24371

4 Credits | Semester IV

A. Introduction:

- To understand of various properties of fluids
- To learn fluid statics and dynamics.
- To understand of Boundary layer, Drag, and Lift
- To understand of Bernoulli's equation
- To Know of various applications of Bernoulli's equation

B. **Course Outcomes:** At the end of the course, students will be able to

[CO 1] Remember various properties of fluids in solving the problems
[CO 2] Understand working of pumps and turbines.
[CO 3] Apply Bernoulli's equation for solutions in fluids
[CO 4] Analyse fluid forces - drags and lift on immersed bodies
[CO 5] Evaluate the dimensionless parameters.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

C. **SYLLABUS**

FLUID PROPERTIES AND FLOW CHARACTERISTICS: Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume – application of continuity equation, energy equation and momentum equation.

FLOW THROUGH CIRCULAR CONDUITS: Hydraulic and energy gradient – Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

DIMENSIONAL ANALYSIS: Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude – Dimensionless parameters- application of dimensionless parameters – Model analysis.

PUMPS: Impact of jets – Euler's equation – Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles – Centrifugal pumps– working principle – work done by the impeller – performance curves – Reciprocating pump- working principle – Rotary pumps –classification.

TURBINES: Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles – work done by water on the runner – draft tube. Specific speed – unit quantities – performance curves for turbines – governing of turbines.

E. TEXT BOOKS

T1. Frank M. White, Fluid Mechanics (Sixth Edition), Tata McGraw-Hill, New Delhi (2008).
T2. J. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall (1999).
T3. Som and Biswas; Fluid Mechnics and machinery; TMH

F. REFERENCE BOOKS

R1. Cengal; Fluid Mechanics; TMH
R2. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Remember various properties of fluids in solving the problems	**3**	**2**	**2**	**1**						**1**		**1**				**2**
[CO2]	Understand working of pumps and turbines.	**3**	**2**	**2**									**1**			**1**	**2**
[CO3]	Apply Bernoulli's equation for solutions in fluids	**2**	**2**	**2**									**2**				**2**
[CO4]	Analyse fluid forces - drags and lift on immersed bodies		**3**	**3**	**2**												**2**
[CO5]	Evaluate the dimensionless parameters.	**1**	**2**	**2**													**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Theory of Machines

Code: BTE24276

4 Credits | Semester IV

A. Introduction:

- To make the student conversant with commonly used mechanism for industrial application.
- To develop competency in drawing velocity and acceleration diagram for simple and complex mechanism
- To develop analytical competency in solving kinematic problems using complex algebra method.
- To develop competency in graphical and analytical method for solving problems in static and dynamic force analysis.
- To develop competency in conducting laboratory experiments for finding moment of inertia of rigid bodies,

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand mechanisms in real life applications.
[CO2] Apply static and dynamic force analysis of slider crank mechanism & kinematic analysis of simple mechanisms.
[CO3] Analyse the flywheel for engines.
[CO4] Evaluate moment of inertia of rigid bodies experimentally.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

GYROSCOPE: Principle of gyroscope, Definition of axes, active and reactive couples; Roll, Yaw and Pitch motions; Gyroscopic effect in a rotor, two wheelers, Four wheelers, ship and airplane.

FRICTION DEVICES: CLUTCHES, BRAKES AND DYNAMOMETERS: Classification of clutches, torque transmission capacity, considerations for uniform wear and uniform pressure theory, single plate and multi-plate clutch, centrifugal clutch, Energy equation and thermal considerations. Classification of brakes, Braking effect, Analysis of Brakes: Block Brake, Band Brake, Band and Block Brake, Internal expansion shoe brake; Braking analysis of four wheelers. Classification of Dynamometers,Analysis of Dynamometers: Prony brake, Rope brake, Hydraulic, Belt Transmission, Epicyclic-Train and Bevis-Gibson torsion.

FLYWHEELS: Significance of flywheel, Turning moment and crank effort diagrams for reciprocating machines, coefficient of fluctuation of speed and energy, Limiting velocity of flywheel, Design of flywheels for engines and punching machines.

GOVERNORS: Necessity of governor, Classification of Governors, Working principle of centrifugal governors, Concept of control force, Control force diagram, Stability of governor, Condition for stability, Concept of isochronism, Sensitivity of governor, Characteristics of governors, hunting.

INTRODUCTION TO DYNAMICS: Newton's Laws of Motion, Applied and constraint forces, Free-body diagrams, conditions for equilibrium, Two and Three forces members, Four force members, Friction forces, Static force analysis with friction. Centroid and Centre of Mass, Mass Moments and products of inertia, Inertia forces and D'alembert's Principle. Planar rotation about fixed centre, Shaking forces and moments, Complex algebra approach, Equation of motion. Application of concepts to dynamic analysis of slider-crank mechanism and 4-bar mechanism. Spatial: Measuring mass moment of Inertia, Transformation of Inertia axes, Euler's equation of motion, Impulse and momentum, Angular impulse and momentum

E. TEXT BOOKS

T1. Thomas Bevan, Theory of Machines, CBS Publishers & Distributors
T2. CleghornW.L. , Mechanisms of Machines, Oxford University Press.

F. REFERENCE BOOKS

R1. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill.
R2. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi.

. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Understand mechanisms in real life applications.	**2**	**3**	**3**	**2**					**1**			**2**		**1**		**2**
[CO2]	Apply static and dynamic force analysis of slider crank mechanism & kinematic analysis of simple mechanisms.	**1**	**3**	**3**	**1**								**1**		**1**		**2**
[CO3]	Analyse the flywheel for engines.	**1**	**2**	×	**1**	×	×	×	×	×	×	×	×	**1**	×	×	**1**
[CO4]	Evaluate moment of inertia of rigid bodies experimentally.	**2**	**2**	**2**	**1**	×	×	×	×	×	**1**	×	**1**	×	×	×	**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Mechanical Measurement and Control

Code: BTE24083
3 Credits | Semester IV

A. Introduction:

- To understand the concepts in measurement.
- To be familiar with different sensors and transducers.
- To build suitable measurement technique.
- To understand various control technique and stability analysis.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Remember the measurement systems, units and dimensions, calibration and correction.

[CO2] Understand the concept of interchangeability and explain the various linear and angular measurement systems.

[CO3] Apply the working principle of auto collimator, CMM and list the applications of them

[CO4] Apply the various form measurements like thread, gear, straightness, flatness, roundness and surface finish

[CO5] Analyze the working of miscellaneous measuring equipment for measuring temperature, velocity, pressure.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO MEASUREMENTSYSTEMS: Introduction to Measurement systems - Sensors, Transducers, classification, static and dynamics characteristics, errors, transduction principles.

MEASUREMENT OF MOTION, FORCE AND TORQUE: Measurement of Motion, Force and Torque - Displacement and speed measurement for translational and rotation systems using potentiometers, LVDT and RVDT, Encoders, accelerometers and gyroscopes. Force and Torque measurements using strain gauges and piezoelectric pickups.

MEASUREMENT OF TEMPERATURE, PRESSURE AND FLOW: Measurement of temperature, pressure and flow - Temperature measurement using Thermistors, RTD, Thermocouple and semiconductor sensors. Pressure measurement using gage, manometers, bellows, diaphragm, differential pressure transmitter. Flow measurement using Venturi-tubes, Rota meters and anemometers

SIGNAL CONDITIONING AND DATA ACQUISITION: Signal conditioning and data acquisition - Basic signal conditioning – bridges, amplifiers, filters, monitoring and indicating systems and data acquisition systems. Modeling and representation of systems - Model of a system, Concept of transfer function, block diagram and state space, Modeling of basic physical systems.

CONTROL CONCEPTS: Control concepts - Open loop and closed loop systems with examples, controller design, and performance measurements-Design of P, PI, PD and PID controllers. Stability analysis - Concept of poles and zeros, Stability analysis of system using root locus, Routh Hurwitz criterion and Phase and gain margins.

E. TEXT BOOKS

T1.Mechanical Measurements by Thomas G Beckwith, Pearson publications
T2.Modern Control Engineering by K.Ogata, Pearson publications

F. REFERENCE BOOKS

R1. Measurement systems by Ernest O Doebelin, Tata McGraw Hill publications
R2. Experimental Methods for Engineers, J P Holman, Tata McGraw Hill publications Dukkipati
R3. Advanced Mechanical Vibrations, Narosa Publications.
R4. Automatic Control Systems" by B C Kuo, Wiley publication.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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	PS O 2	PSO 3	PS O 4
[CO1]	Remember the measurement systems, units and dimensions, calibration and correction.	**1**				**2**	**1**			**1**			**1**				**2**
[CO2]	Understand the concept of interchangeability and explain the various linear and angular measurement systems.	**1**			**1**	**1**	**1**						**1**		**1**		**1**
[CO3]	Apply the working principle of auto collimator, CMM and list the applications of them		**2**		**1**	**1**							**1**			**1**	**2**
[CO4]	Apply the various form measurements like thread, gear, straightness, flatness, roundness and surface finish		**2**		**1**	**1**							**1**			**1**	**2**
[CO5]	Analyze the working of miscellaneous measuring equipment for measuring temperature, velocity, pressure.		**2**	**1**	**1**	**1**							**1**				**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Biology for Engineers

Code: BTE23018

3 Credits | Semester IV

A. Introduction:

- To understand Biological concepts from an engineering perspective
- To understand the inter-connection between biology and future technologies
- To motivate technology application for biological and life science challenges

B. Course Outcomes: At the end of the course, students will be able to

[CO1**]** Understand the biological concepts from an engineering perspective

[CO2] Understand the concepts of biological sensing and its challenges

[CO3] Understand development of artificial systems mimicking human action

[CO4] Integrate biological principles for developing next generation technologies

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. Engineering designs inspired by examples in biology-- Micro- to Macro- scales. Comparing natural vs. human-made machines. Biosensor. Engineering aspects of some Nobel Prizes in Physiology and Medicine & Chemistry recent advances in Biology

TOOLS AND TECHNIQUES: Biosafety laboratory practices, Buffers in biology, buffering capacity and pKa, Observing cell surface and intracellular contents using light and/or fluorescence microscopy, Measuring mechanical strength of cells - osmolality and elasticity of biological membranes

CLASSIFICATION: A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E. coli, S. cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

BIO MOLECULES: Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis

GENETICS AND INFORMATION TRANSFER: Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept; Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis.Teach meiosis and Mitosis as a part of genetics. Meiosis and Mitosis be taught as a part of genetics.Emphasis to be give not to themechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

E. TEXT BOOKS

T1. Molecular Genetics (Second edition),Stent, G.S.; and Calendar, R.W.H.Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

T2. Microbiology, Prescott, L.MJ.P.HarleyandC.A.Klein1995.

F. REFERENCE BOOKS

R1. Biology:Aglobalapproach:Campbell,N.A.;Reece,J.B.;Urry,Lisa;Cain,M,L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B.PearsonEducationLtd

R2. Outlines of Biochemistry, Conn, E.E;Stumpf, P.K;Bruening,G;Doi,R.H.,JohnWileyand Sons

R3. Principles of Biochemistry (VEdition),ByNelson, D.L.;andCox,M.M.W.H.Freemanand Company

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand the biological concepts from an engineering perspective	3	1	1	1	-	-	-	-	-	1	1	1	3	1	1	1
[CO2]	Understand the concepts of biological sensing and its challenges	2	2	1	1	-	-	-	-	-	2	1	1	2	2	1	1
[CO3]	Understand development of artificial systems mimicking human action	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
[CO4]	Integrate biological principles for developing next generation technologies	2	2	1	1	-	-	-	-	-	2	1	1	2	2	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Applied Thermodynamics Lab

Code: BTE24277

1 Credits | Semester IV

A. Introduction:

- To learn about of 1st law for reacting systems and heating value of fuels
- To learn about gas and vapor cycles and their first law and second law efficiencies
- To understand about the properties of dry and wet air and the principles of psychometric
- To learn about gas dynamics of air flow and steam through nozzles
- To learn the about reciprocating compressors with and without intercooling
- To analyze the performance of steam turbines

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Remember the thermodynamic properties of systems including: Pressure, Temperature, Internal energy, Enthalpy, Specific heat, Entropy, Property tables, The ideal gas equation of state.
[CO2] Understand the processes in thermodynamic systems including: work, heat transfer, mass and energy balances, the first and second laws of thermodynamics and changes in exergy.
[CO3] Apply thermodynamic systems including heat engine cycles such as: the Carnot-, Otto-, Diesel-, Stirling- , Brayton- and Rankine cycle, Refrigerant cycles are also included.
[CO4] Analyse working of impulse and reaction turbines
[CO5] Evaluate heat balance sheet for a boiler

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	To study low pressure boilers and their accessories and mountings.
2	To study high pressure boilers and their accessories and mountings.

3	To study the working of impulse and reaction steam turbines
4	To prepare heat balance sheet for given boiler.
5	To find power output & efficiency of a steam turbine.
6	To find calorific value of a sample of fuel using Bomb calorimeter.
7	To study and find volumetric efficiency of a reciprocating air compressor.
8	To find dryness fraction of steam by separating and throttling calorimeter

E. TEXT BOOKS

T1.Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

T2.Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

F. REFERENCE BOOKS

R1.Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

R2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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	PS O 2	PS O 3	PS O 4
[CO1]	Remember the thermodynamic properties of systems including: Pressure, Temperature, Internal energy, Enthalpy, Specific heat, Entropy, Property tables, The ideal gas equation of state.	**1**									**1**		**1**				**1**
[CO2]	Understand the processes in thermodynamic systems including: work, heat transfer, mass and energy balances, the first and second laws of thermodynamics and changes in exergy.	**1**	**2**	**2**				**2**			**1**		**1**		**1**		**1**
[CO3]	Apply thermodynamic systems including heat engine cycles such as: the Carnot-, Otto-, Diesel-, Stirling- ,	**2**	**2**	**2**	**2**								**1**				**2**

	Brayton- and Rankine cycle, Refrigerant cycles are also included.																
[CO4]	Analyse working of impulse and reaction turbines	**1**	**2**	**2**	**1**								**1**		**1**		**2**
[CO5]	Evaluate heat balance sheet for a boiler	**2**						**1**		**1**		**1**			**2**		**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Fluid Mechanics and Machinery Lab

Code: BTE24372

1 Credits | Semester IV

A. Introduction:

- This course will provide a basic understanding of flow measurements using Various types of flow measuring devices, calibration and losses associated with these devices.
- Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using Characteristics curves.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Understand preventive maintenance of hydraulic turbines
[CO2] Apply Bernoulli's Theorem to determine the coefficient of discharge of flow measuring devices.
[CO3] Analyze performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
[CO4] Evaluate the energy flow pattern through the hydraulic turbines and pumps.
[CO5] Create characteristics curves of hydraulic turbines and pumps with the experimental data.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiment
1	Determination of the Coefficient of discharge of given Orifice meter.
2	Determination of the Coefficient of discharge of given Venturi meter.

3	Determination of friction factor for a given set of pipes.
4	Conducting experiments and drawing the characteristic curves of centrifugal pump
5	Conducting experiments and drawing the characteristic curves of reciprocating pump.
6	Conducting experiments and drawing the characteristic curves of Gear pump.
7	Conducting experiments and drawing the characteristic curves of Pelton wheel.
8	Conducting experiments and drawing the characteristics curves of Francis turbine.

E. TEXT BOOKS

T1. Frank M. White, Fluid Mechanics (Sixth Edition), Tata McGraw-Hill, New Delhi (2008).
T2. J. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall (1999).
T3. Som and Biswas; Fluid Mechnics and machinery; TMH

F. REFERENCE BOOKS

R1. Cengal; Fluid Mechanics; TMH
R2. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PSO 4
[CO1]	Understand preventive maintenance of hydraulic turbines				**2**					**1**			**2**			**3**	
[CO2]	Apply Bernoulli's Theorem to determine the coefficient of discharge of flow measuring devices.	**1**	**2**	**2**	**1**										**2**		**2**
[CO3]	Analyze performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.		**2**	**3**	**1**										**1**		**1**
[CO4]	Evaluate the energy flow pattern through the hydraulic turbines and pumps.	**1**	**1**	**2**	**2**												**1**
[CO5]	Create characteristics curves of hydraulic turbines and pumps with the experimental data.	**1**		**1**							**1**			**1**			**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Theory of Machines Lab

Code: BTE24278

1Credits | Semester IV

A. Introduction:

- To make the student conversant with commonly used mechanism for industrial application.
- To develop competency in drawing velocity and acceleration diagram for simple and
- Complex mechanism
- To develop analytical competency in solving kinematic problems using complex algebra
- Method.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Understand mechanisms in real life applications
[CO2] Apply kinematic analysis on simple mechanisms.
[CO3] Apply static and dynamic force analysis on slider crank mechanism.
[CO4] Analyze velocity and acceleration of mechanisms by vector and graphical methods.
[CO5] Evaluate moment of inertia of rigid bodies experimentally.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	To understand the gyroscopic effect.
2	To understand static and dynamic balancing.
3	To understand the balancing of reciprocating piston.
4	To understand the journal bearing characteristics.

5	General vibrational setup.
6	To understand the whirling of shaft.
7	Rotor experiment (balancing, bearing parameter etc.).
8	Calculation of sensitivity of Governor

E. TEXT BOOKS

T1. Thomas Bevan, Theory of Machines, CBS Publishers & Distributors
T2. CleghornW.L. , Mechanisms of Machines, Oxford University Press.

F. REFERENCE BOOKS

R1. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill.
R2. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand mechanisms in real life applications	2	2	2	2	1							1		1		1
[CO2]	Apply kinematic analysis on simple mechanisms.		3	3											1		2
[CO3]	Apply static and dynamic force analysis on slider crank mechanism.		3	3											1		2
[CO4]	Analyze velocity and acceleration of mechanisms by vector and graphical methods.		3	3	2									1	1		2
[CO5]	Evaluate moment of inertia of rigid bodies experimentally.	2	2	2	2								2				2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Mechanical Measurement and Control Lab

Code: BTE24088

1Credits | Semester IV

A. Introduction:

- Develop ability to set up measurement systems with a control environment
- Develop an ability to design and utilize advanced control systems

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Understand the working of various measuring instruments.
[CO2] ApplyMatlabRealTime programming to collect process data.
[CO3]Analyze controller designs to regulate and control various processes and systems.
[CO4] Evaluate the data collected by instruments to determine actual value.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	To study about measurements and controls
2	Performance on linear measurements using Vernier Calliper, Vernier height gauge, and micrometer
3	Performance on Angular Measurement using Bevel protector and Sine bar.
4	To study about Temperature Measurement.
5	Performance on Gear and Screw Thread Measurement (two wire method, screw pitch gauge).
6	To study about Stress, Strain and Force Measurements.

7	To Study about Torque and Speed and acceleration Measurement.
8	To Study about Surface Measurements

E. TEXT BOOKS

T1.Mechanical Measurements by Thomas G Beckwith, Pearson publications
T2.Modern Control Engineering by K.Ogata, Pearson publications

F. REFERENCE BOOKS

R1. Measurement systems by Ernest O Doebelin, Tata McGraw Hill publications
R2. Experimental Methods for Engineers, J P Holman, Tata McGraw Hill publications Dukkipati
R3. Advanced Mechanical Vibrations, Narosa Publications.
R4. Automatic Control Systems" by B C Kuo, Wiley publication.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3	PSO 4
[CO1]	Understand the working of various measuring instruments.	2	1	1	1										1		1
[CO2]	ApplyMatlabRealTime programming to collect process data.	2				3							1	2			
[CO3]	Analyse controller designs to regulate and control various processes and systems.		3	2		3											1
[CO4]	Evaluate the data collected by instruments to determine actual value.				3								1	1			1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University Jharkhand

Syllabus of

B.Tech. in Mechanical Engineering

Semester-V

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes Lab-I	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Summer Internship –I (3-4 week)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronic Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II – (4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Subject: Heat & Mass Transfer

Code: BTE25117
4 Credits | Semester V

A. Introduction:

- The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
- Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
- The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer

[CO2] The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer

[CO3] The students will be able to design devices such as heat exchangers and estimate the insulation needed to reduce heat losses where necessary.

[CO4] Students will able to design heat exchangers based on the LMTD and ε- NTU analysis.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

CONDUCTION: Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances,critical insulation thickness, lumped system approximation and Biotnumber,heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.

CONVECTION: Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer,Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection,Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

THERMAL RADIATION: Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation,Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method

HEAT EXCHANGER: Types of heatexchangers, Analysis and design of heat exchangers using bothLMTD and ε- NTU methods.

BOILING AND MASS TARNSFER: Boiling and Condensation heat transfer, Pool boiling curve Introduction mass transfer, Similarity between heat and mass transfer

E. TEXT BOOKS

T1. A. Bejan, Heat Transfer John Wiley, 1993

T2. J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.

T3. F.P.Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007.

F. REFERENCE BOOKS

R1. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002

R2. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer		**3**	**3**									**3**		**2**		**1**
[CO2]	The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer	**3**			**3**								**3**		**2**		
[CO3]	The students will be able to design devices such as heat exchangers and estimate the insulation needed to reduce heat losses where necessary.		**3**	**3**		**3**									**3**	**2**	
[CO4]	Students will able to design heat exchangers based on the LMTD and ε-NTU analysis.		**3**	**3**	**3**												
[CO5]																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Solid Mechanics

Code: BTE25282

4 Credits | Semester V

A. Introduction:

- Students would be introduced to fundamentals of Engineering Mechanics with emphasis on force systems, axioms, and dynamics of rigid bodies.
- Second part of the course would be an introduction to Solid Mechanics, and students would be introduced to basic concepts of mechanics of deformable media.
- Concept of stress tensor, strain tensor, strain rates, constitutive relations, and applications to one/two dimensional problems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components;

[CO2] Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods;

[CO3] Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams;and

[CO4] Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

SIMPLE STRESSES AND STRAINS. Concept of stress and strain, St. Venant's principle, stress and strain diagram,Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

COMPOUND STRESSES AND STRAINS. Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

BENDING MOMENT AND SHEAR FORCE DIAGRAMS. Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

FLEXURAL STRESSES. Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES. Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections. Slope and deflection-Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

E. TEXT BOOKS

T1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.

T2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.

T3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004

T4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979

F. REFERENCE BOOKS

R1. Laboratory Manual of Testing Materials - William Kendrick Hall

R2. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002. 7. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components;	**3**	**3**											**1**			
[CO2]	Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods;		**3**		**3**												
[CO3]	Analyse various situations involving structural members		**3**										**3**				**2**

	subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams;and																
[CO4]	Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members.		**3**										**3**	**2**			
[CO5]																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Manufacturing Process I

Code: BTE25283

3 Credits | Semester V

A. Introduction:

- To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products.

[CO2]Upon completion of this course, the students will have an overview of the mechanical behavior and application of tools used in machining purpose.

[CO3] Upon completion of this course, the students will able to examine the different Techniques involved in traditional machining process.

[CO4] Students will able to understand the manufacturing process of complex shape products.

[CO5] Upon completion of this course, students will analyze the basic components of Lathe machine, Milling Machine, Drilling machine, Grinding Machine and different tools handled.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

METAL CASTING AND FORMING: Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; and sheet forming (shearing, deep drawing, bending),load estimation for bulk forming(forging, rolling, extrusion, drawing) principles of powder metallurgy

METAL CUTTING: Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

METAL JOINING: Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters,

ADVANCED MACHINING: Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant &mask ant, process parameters, MRR and surface finish.

ADVANCED MACHINING: Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining**,** Additive manufacturing: Rapid prototyping and rapid tooling

E. TEXT BOOKS

T1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014

T2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems

F. REFERENCE BOOKS

R1. Degarmo, Black &Kohser, Materials and Processes in Manufacturing

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products.	**3**											**3**		**3**		**3**
[CO2]	Upon completion of this course, the students will have an overview of the mechanical behaviour and application of tools used in machining purpose.	**3**				**3**									**3**	**2**	
[CO3]	Upon completion of this course, the students will able to examine the different Techniques involved in traditional machining process.				**3**	**3**								**3**			**2**
[CO4]	Students will able to understand the manufacturing process of complex shape products.		**3**		**3**												
[CO5]	Upon completion of this course, students will analyze the basic components of Lathe machine, Milling Machine, Drilling machine, Grinding Machine and different tools handled.	**3**											**3**				**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Design of Machine Element

Code: BTE25120

3 Credits | Semester V

A. Introduction:

- A strong background in mechanics of materials based failure criteria underpinning the safety-critical design of machine components
- An understanding of the origins, nature and applicability of empirical design principles, based on safety considerations
- An overview of codes, standards and design guidelines for different elements
- An appreciation of parameter optimization and design iteration
- An appreciation of the relationships between component level design and overall machine system design and performance

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Upon completion of this course, students will get an overview of the design methodologies employed for the design of various machine components

[CO2] Students will able to examine the product dimension and meet quality standard of the products.

[CO3] Students will able to work on safety and design features of different parts used in various applications

[CO4] Student will able to estimate the fatigue strength of the machine components based on their safety features.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Introduction to Mechanical Engineering Design- Review of models of Solid mechanics, uncertainties in design equations and factor of safety.Role of off the shelf available machine elements and standards. Standard numbering system including BIS designations of materials. Application of theories of failure to design.

DESIGN PROCEDURE AND APPLICATIONS: Design procedure and applications of Statically Loaded Machine Elements- Design of elements subjected to simple loading.Riveted joints, Screws including power screws Bolted joints including eccentrically loaded joints.Axles, and coupling, Clutches and brakes.

FATIGUE- INTRODUCTION: Fatigue- Introduction to design for fatigue strength. Endurance and modifying factors. Surface strength. Review of design procedure of fatigue failure with application to the design of bolts and springs subjected to fatigue loading

DESIGN PROCEDURE AND APPLICATIONS: Design procedure and applications of Dynamically Loaded Machine Elements. Shafts, Spur, helical, bevel and worm gears, Journal and rolling

DESIGN PROCEDURE AND APPLICATIONS OF CONTACT BEARINGS: Design procedure and applications of contact bearings, Belts and chains. Assemblies of various machine elements like those of a screw jack and a gearbox.

E. TEXT BOOKS

T1.Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw-Hill International; 1989.
T2.Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan, 1992.
T3.Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley, 1994.
Spottes, M.F., Design of Machine elements, Prentice-Hall India, 1994.
T4.R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, 1998

F. REFERENCE BOOKS

R1.Budynas, R. G., &Nisbett, J. K..Shigley's mechanical engineering design: McGraw-Hill.
R2.Norton, R. L. Machine design: an integrated approach: Prentice Hall
R3.Spotts, M. F., Shoup, T. E., &Hornberger, L. E. Design of machine elements: Pearson Prentice Hall
R4.Bhandari, V. B. Design of Machine Elements: McGraw-Hill Education (India) Pvt Ltd

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Upon completion of this course, students will get an overview of the design methodologies employed for the design of various machine components	**3**											**3**	**3**	**2**		
[CO2]	Students will able to examine the product dimension and meet quality standard of the products.		**3**		**3**	**3**									**3**		
[CO3]	Students will able to work on safety and design features of different parts used in various applications			**3**	**3**											**2**	
[CO4]	Student will able to estimate the fatigue strength of the machine components based on their safety features.	**3**			**3**									**3**			
[CO5]																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Professional Practice, Law & Ethics

Code: BTE25299

3 Credits | Semester V

A. Introduction:

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.
- To develop some ideas of the legal and practical aspects of their profession.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] To familiarize the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession.

[CO2]To give a good insight into contracts and contracts management in Mechanicalengineering, dispute resolution mechanisms; laws governing engagement of labour.

[CO3] To give an understanding of Intellectual Property Rights, Patents.

[CO4] To make the students understand the types of roles they are expected to play in the society as practitioners of the mechanical engineering profession.

[CO5] To develop good ideas of the legal and practical aspects of their profession.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

PROFESSIONAL PRACTICE & ETHICS: Professional Practice - Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards).Professional Ethics- Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

GENERAL PRINCIPLES OF CONTRACTS MANAGEMENT: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical “RedFlag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions.Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build- Own-Operate & variations; Public- Private Partnerships; International Commercial Terms.

ARBITRATION, CONCILIATION AND ADR (ALTERNATIVE DISPUTE RESOLUTION) SYSTEM: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law –Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance.Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Look Adalats.

ENGAGEMENTOF LABOUR AND LABOUR & OTHER CONSTRUCTION-RELATED LAWS: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining.Industrial Employment (Standing Orders) Act, 1946; Workmen’s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

LAW RELATING TO INTELLECTUAL PROPERTY: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet –Remedies and procedures in India,Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

E. TEXT BOOKS

T1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
T2. The National Building Code, BIS, 2017
T3. RERA Act, 2017
T4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
T5. NeelimaChandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
T6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
T7. Dutt (1994), Indian Contract Act, Eastern Law House
T8. Anson W.R. (1979), Law of Contract, Oxford University Press
T9.Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
T10. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.

F. REFERENCE BOOKS

R1. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
R2. Bare text (2005), Right to Information Act
R3. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
R4. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
R5. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
R6. Vee, Charles &Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd
R7. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
R8. Ethics in Engineering- M.W.Martin&R.Schinzinger, McGraw-Hill

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	To familiarize the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession.								**1**								**2**
[CO2]	To give a good insight into contracts and contracts management in Mechanicalengineering, dispute resolution mechanisms; laws governing engagement of labour.							**1**		**2**							**2**
[CO3]	To give an understanding of Intellectual Property Rights, Patents.							**2**			**2**				**2**		
[CO4]	To make the students understand the types of roles they are expected to play in the society as practitioners of the mechanical engineering profession.															**1**	
[CO5]	To develop good ideas of the legal and practical aspects of their profession.											**1**					**3**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Essence of Indian Knowledge Tradition

Code: BTE25095

0 Credits | Semester V

A. Introduction:

- The course aims at imparting basic principles of thought process, reasoning and differencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Basic principles of thought process, reasoning and differencing.

[CO2] Introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care systems.

[CO3] Focuses on Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM: Basic structure of Indian Knowledge System. अष्टादशविद्या -४वेद,४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि)

BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM: ६वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष, छंद) ४ उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

MODERN SCIENCE AND INDIAN KNOWLEDGE SYSTEM: Modern Science and Indian Knowledge System.

YOGA AND HOLISTIC HEALTH CARE LAWS: Yoga and Holistic Health care.

CASE STUDIES: Case studies.

E. TEXT BOOKS

T1. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya.
T2.Vidya Bhavan, Mumbai. 5th Edition, 2014 SwamiJitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan
T3.Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan.
T4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
T5.Fritzof Capra, The Wave of life .

F. REFERENCE BOOKS

R1. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay
R2. Foundation, Velliarnad, Arnakulam Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
R3. GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya
R4. VidyanidhiPrakashan, Delhi 2016 RNJha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi
R5.Prakashan, Delhi 2016 P B Sharma (English translation), ShodashangHridayan

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Basic principles of thought process, reasoning and differencing.						**2**	**1**									**1**
[CO2]	Introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care systems.						**1**				**1**						**1**
[CO3]	Focuses on Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.										**1**						**1**
[CO4]																	
[CO5]																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Heat& Mass Transfer Lab

Code: BTE25123

1Credits | Semester V

A. Introduction:

- To provide experience on testing, and analysis of heat transfer equipment in various approaches

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] The students have understood how heat transfer occurs for different equipment and worked out the parameters studied in theory

[CO2] The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

[CO3] The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer.

[CO4] After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	Temperature distribution in a metal rod
2	Thermal Conductivity of metal rod
3	Radiation
4	Natural convective heat transfer

5	Forced convective heat transfer
6	Double pipe heat exchanger
7	Shell and Tube Heat exchanger
8	Plate Heat Exchanger
9	Condenser
10	Heat Transfer in Jacketed Kettle
11	Open pan evaporator

E. Text Book:

T1. W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.,

F. Reference Books:

R1. G Chandrasekhar, Laboratory Experiments in Chemical and Allied Engineering:,Penram International Publishing (India) Pvt. Ltd.,

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	The students have understood how heat transfer occurs for different equipment and worked out the parameters studied in theory	**3**			**3**								**3**			**1**	
[CO2]	The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.			**3**		**3**								**2**	**2**		
[CO3]	The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer.		**3**														**2**
[CO4]	After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer.		**3**			**3**									**1**		**2**
[CO5]																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Manufacturing Process -I Lab

Code: BTE25284

1Credits | Semester V

A. Introduction:

- To provide experience on testing, and analysis of components developed using casting, welding, and sheet metal forming processes.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Understand the idea for selecting materials for patterns. Types and allowances of patterns used in casting and analyze the components of moulds. Design core, core print and gating system in metal casting processes

[CO2] Understand the application of arc and TIG welding processes.

[CO3] To understand the application of soldering and brazing process.

[CO4] Develop process-maps for metal forming processes using plasticity principles. Identify the effect of process variables to manufacture defect free products.

[CO5] To understand the principles of forging and rolling operation and develop material using powder metallurgy technique.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	Pattern Design and Making
2	Moulding sand properties testing – Exercise for strengths and permeability
3	Moulding and Casting
4	ARC Welding – Lap and Butt Joint

5	TIG Welding Practice
6	Soldering and Brazing Practice
7	Blanking and Piercing operation
8	Bending Operation
9	Forging operation
10	Rolling Operation
11	Powder metallurgy

E. TEXT BOOKS

T1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014

T2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems

F. Reference Books:

R1. Degarmo, Black &Kohser, Materials and Processes in Manufacturing

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand the idea for selecting materials for patterns. Types and allowances of patterns used in casting and analyze the components of moulds. Design core, core print and gating system in metal casting processes	3											3	2	3		
[CO2]	Understand the application of arc and TIG welding processes.	3				3									3		3
[CO3]	To understand the application of soldering and brazing process.	3											3		3		3
[CO4]	Develop process-maps for metal forming processes using plasticity principles. Identify the effect of process variables to manufacture defect free products.		2			3									2		3
[CO5]	To understand the principles of forging and rolling operation and develop material using powder metallurgy technique.	3											3		3		3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Design of Machine Elements Lab

Code: BTE25374

1Credits | Semester V

A. Introduction:

- To provide experience on design and analysis of different joints and understand the strength of various mechanical components under different loading conditions.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] To demonstrate the concepts discussed in Design of Machine Elements.
[CO2] To visualize and understand the development of stresses in structural members and experimental determination of stresses in members.
[CO3] To analyze the fatigue strength of the machine components.
[CO4] To design and examine the strength of gears and bearings.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	Design of bolted joints
2	Design of Riveted joints
3	Design of Cluthces
4	Design of Brakes
5	Design for fatigue strength
6	Design procedure for fatigue failure

7	Design of shafts
8	Design of Spur gear
9	Design of Helical Gears
10	Design of journal Bearing
11	Design of Roller bearing

E. Text Book:

T1. "Theory of Machines", Sadhu Singh, Pearson Education, 2nd Edition, 2007.
T2. "Mechanical Vibrations", G.K. Grover, NemChandand Bros, 6th Edition, 1996.

F. Reference Books:

R1. "Shigley"s Mechanical Engineering Design", Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.
R2. "Design of Machine Elements", V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.

. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	To demonstrate the concepts discussed in Design of Machine Elements.		**2**	**3**											**3**		**2**
[CO2]	To visualize and understand the development of stresses in structural members and experimental determination of stresses in members.	**3**			**3**												**2**
[CO3]	To analyze the fatigue strength of the machine components.	**3**	**3**													**3**	
[CO4]	To design and examine the strength of gears and bearings.	**3**		**3**												**3**	
[CO5]																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject:Summer Internship-1(3-4 Weeks)

Code: BTE25285

2 Credits | Semester V

A. Introduction:

- Following are the intended objectives of internship training:
- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the ‘Industrial Internship’ in classroom will be use in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job

GUIDELINES FOR INTERNSHIP

Summer Internship -1 should be undertaken in an industry/Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/Institutes/Schemes.

S.No.	Suggested Schedule	Suggested Duration (In weeks)	Activities
1	Summer/winter vacation after 2nd/3rd Semester	3-4	Inter/Intra Institutional Activities

Syllabus of

B.Tech. in Mechanical Engineering

Semester-VI

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes Lab-I	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Summer Internship –I (3-4 week)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronic Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II –(4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Subject: Manufacturing Process - II

Code: BTE25119

4 Credits | Semester VI

A. Introduction:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

B. Course Outcomes: At the end of the course

[CO1] Remembering the basic theories of machining and selection of machine tool.

[CO2] Understanding the principles behind working of each machine tools

[CO3] Applying the knowledge of kinematics in the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.

[CO4] Analyzing the basic functions of different machine tools.

[CO5] Evaluating different formulas used in analysis of machining operations.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

THEORY OF METAL CUTTING: Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature. Orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

TURNING MACHINES: Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle.

SHAPER, MILLING AND GEAR CUTTING MACHINES: Shaper, Types of operations. Drilling, reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting –

forming and generation principle and construction of gear milling, hobbing and gear shaping processes –finishing of gears.

ABRASIVE PROCESS AND BROACHING: Abrasive processes: grinding wheel – specifications and selection, types of grinding process–cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications– concepts of surface integrity, Broaching machines: broach construction – push, pull, surface and continuous broaching machines.

CNC MACHINING: Numerical Control (NC) machine tools – CNC types, constructional details, special features, Machining centre, part programming fundamentals CNC –manual part programming –micromachining – wafer machining.

E. TEXT BOOKS

T1.Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters.

T2.Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi.

T3.Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications.

F. REFERENCE BOOKS

R1. Fundamental of metal cutting and machine tools– B. L. Juneja, New age international limited.

R2. Production Technology – R.B. Gupta, Satya Prakashan, New Delhi.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES								CORRELATION WITH PROGRAM SPECIFIC OUTCOMES							
		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
[CO1]	Remembering the basic theories of machining and selection of machine tool.	**3**	**2**	**3**		**2**	**2**					**1**		**2**	**3**	**2**	
[CO2]	Understanding the principles behind working of each machine tools	**3**		**2**		**2**									**2**	**2**	
[CO3]	Applying the knowledge of kinematics in the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.	**3**		**2**								**2**		**2**	**3**		
[CO4]	Analyzing the basic functions of different machine tools.	**3**				**2**									**3**		
[CO5]	Evaluating different formulas used in analysis of machining operations.	**2**		**2**											**3**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Refrigeration & Air Conditioning

Code: BTE26164

4 Credits | Semester VI

A. Introduction:

This course is designed to inculcate an understanding of the television production Process, to make the students aware about production techniques and train the students to handle the various equipment, which are used in television production. It will also make the students aware about the stages of production and camera handling.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO 1] Understanding the various thermodynamic cycles used in refrigeration and air conditioning.
[CO 2] Applying the knowledge of basic science in refrigeration.
[CO 3] Analyzing various theories and their mathematical equations by real data.
[CO 4] Evaluating performance of different refrigeration system.
[CO 5] Creating curiosity to learn about new development in field of refrigeration and A.C.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BASICS OF REFRIGERATION: Definition of refrigeration, Necessity of refrigeration
Unit of refrigeration, C.O.P. and refrigerating effect, Concept of heat engine, heat pump and refrigerator,Methods of refrigeration: - Ice refrigeration by expansion of air Refrigeration by throttling of gas Vapour refrigeration system Steam jet refrigeration system, Non-conventional methods of refrigeration like Vortex tube, Pulse tube refrigeration, and solar refrigeration.Refrigeration Cycles: Reversed Carnot Cycle, Bell Coleman air refrigerator, Vapour Compression Cycle, Vapour Absorption system.

VAPOUR COMPRESSION CYCLE (V.C.C):principle, components, Representation on P-H and T-S diagram, effects of wet compression, dry compression, calculation of COP, Effect of superheating, under cooling, suction pressure and discharge pressure.Actual V.C.C., (simple numerical), Methods of improving COP (no description).Introduction to multistage V.C.C., its necessity advantages.

VAPOUR ABSORPTION SYSTEM: Principle, components and working of aqua- ammonia system (simple & practical) Li-Br Absorption System Electrolux Refrigeration System, Desirable properties of Refrigerant and absorbent used in Vapour Absorption System.Comparison of vapour compression refrigeration system and vapour absorption refrigeration system.

REFRIGERANTS AND EQUIPMENT SELECTION: Classification of refrigerants, Desirable properties of refrigerants, Nomenclature of refrigerants.Selection of refrigerant for specific applications, Concept of Green House Effect, Ozone depletion, Global warming, Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants etc.System components: Compressors, Condensers, Expansion devices.

REVIEW OF PSYCHROMETRY AND AIR-CONDITIONING PROCESSES: Definition and necessity of air conditioning,Comfort conditions, Psychometric chart, Psychometric processes, Bypass Factor, ADP, concept of SHF, RSHF, ERSHF, Simple numerical using Psychometric chart.Equipments used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils.Classification of A.C. systems.cooling load calculations: Components of cooling load- sensible heat gain and latent heat gain sources, calculation of cooling load (No numericals).

E. TEXT BOOKS

T1. Refrigeration and Air Conditioning, C.P. Arora, TMH
T2. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House

F. REFERENCE BOOKS

R1. A Course in Refrigeration & Air Conditioning, Domkundwar, DhanpatRai .

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Understanding the various thermodynamic cycles used in refrigeration and air conditioning.	**3**					**2**										
[CO2]	Applying the knowledge of basic science in refrigeration.	**3**					**2**										
[CO3]	Analyzing various theories and their mathematical equations by real data.	**3**	**2**											**2**			
[CO4]	Evaluating performance of different refrigeration system.	**2**	**3**		**3**									**2**			
[CO5]	Creating curiosity to learn about new development in field of refrigeration and A.C.	**2**					**3**										

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Subject: Internal Combustion Engine

Code: BTE26300

3 Credits| semester VI

A.Introduction: Due to the wide range of applications of Internal Combustion Engines operated as energy machine in our live, teach the basic knowledge to the students studying Mechanical Engineering about the engine terminology within the scope of the curriculum disclosure of issues such as history, basic concepts, motor cycle calculation, Mixture Characteristics, combustion, the actual cycle, knock, power calculations and the gas exchange.

B. Course Outcomes: At the end of the course, students will be able to

[CO 1] Remembering the theories of various power cycles.
[CO2] Understanding the working principles and mathematical relations for various cycles.
[CO3] Analyzing the factor affecting performance of various cycles.
[CO4] Creating a learning ability about new development in the field of I. C.Engines.
[CO5] Evaluating the performance of thermodynamic cycles and relative comparison among them.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D.SYLLABUS

Introduction: Internal and external combustion engines; classification and nomenclature of I.C. Engines, Thermodynamic analysis and comparison of air standard Otto, diesel and dual combustion cycles. Fuels: Conventional fuels for S.I. and C.I. engines, fuel properties and their influence ofengine performance; octane and cetane rating of fuels, alternative fuels, pollutants from SI and CI Engines.

Carburetion and fuel Injection: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, drawbacks of carburetor, petrol injection systems; single- point and multi-point fuel inject systems; requirements of a diesel injection system; types of diesel inject systems, injection pump and injectors, fuel filters.

Ignition, Lubrication and Cooling Systems: Requirements of ignition system; types of ignition systems, advancing ignition timing; spark plugs. Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

Engine Testing and Performance: Measurement of various engine performance parameters; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves.

Supercharging: Objectives of supercharging, its advantages and application, performance of superchargers, Turbo charged engines, supercharging of SI and CI Engines, limitations of supercharging.

E.Text Books

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. A Course in Internal Combustion Engines -M.L.Mathur&R.P.Sharma, DhanpatRai

F.Reference Books

3. The Internal Combustion Engines: C.F. Taylor & E.S. Taylor, Int. Textbook Co.
4. Internal Combustion Engine Fundamentals: J.B. Heywood, McGrawhill Book Co.
5. Fundamentals of Internal Combustion Engines: H.N. Gupta, PHI
6. Internal Combustion Engines: Shyam K. Agarwal, New Age International
7. A Text Book of Internal Combustion Engines: R K. Rajput, Laxmi Publ.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES								
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O 1**	**PS O 1**	**PS O 1**	**PS O 1**
[CO1]	Remembering the theories of various power cycles.	**3**					**2**										
[CO2]	Understanding the working principles and mathematical relations for various cycles.	**3**					**2**										
[CO3]	Analyzing the factor affecting performance of various cycles.	**2**			**2**												
[CO4]	Creating an learning ability about new development in the field of I. C.Engines.	**2**					**3**										
[CO5]	Evaluating the performance of thermodynamic cycles and relative comparison among them.	**2**															

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlatio

Subject: Microprocessors in Automation

Code: BTE26167

3 Credits | Semester VI

A. Introduction:

- To introduce the basic concepts of Digital circuits, Microprocessor system and digital controller.
- To learn Microprocessor and machine cycle used in programming.
- To understand assembly language programming used in industry

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Understand the use of microprocessors for automation.
[CO2]Applying the knowledge of microcontrollers to implement in automization.
[CO3] Analyzing the system and suggesting best possible selection of controllers.
[CO4] Develop codes for controlling any physical system.
[CO5] Broad knowledge of section criteria for microprocessor.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO NUMBER SYSTEM AND LOGIC CIRCUITS: Number Systems, codes, digital electronics: Logic Gates, combinational circuits design,Flip-flops, Sequential logic circuits design: Counters, Shift registers.

MICROPROCESSOR AND MACHINE CYCLE: Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals.Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.

ASSEMBLY LANGUAGE PROGRAMMING: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling.Programmable interrupt controller; Interfacing peripherals: Programmable peripheral interface (8255).

INTERFACING IN PROGRAMMING AND DATA COMMUNICATION: Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control.Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features.

DIGITAL CONTROL: Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, Z-Transform, Digital Filter.Implementation of Digital Algorithm.

E. TEXT BOOKS

T1.Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited

T2.Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata McGraw-Hill Publishing Company Ltd.

T3.Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.

F. REFERENCE BOOKS

R1. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition, 2007).

R2. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand the use of microprocessors for automation.	**3**	**2**	**2**		**3**											
[CO2]	Applying the knowledge of microcontrollers to implement in automization.	**3**				**3**											
[CO3]	Analyzing the system and suggesting best possible selection of controllers.	**3**	**3**	**3**		**1**											
[CO4]	Develop codes for controlling any physical system.	**2**		**3**													
[CO5]	Broad knowledge of section criteria for microprocessor.	**3**															

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Subject: Mechatronic Systems

Code: BTE26166

3 Credits | Semester VI

A. Introduction:

- To understand the basic concepts and characteristics of measurement systems.
- To learn various types of sensors and transducers various mechanical, electrical and pneumatic actuation systems.
- To learn various mechanical, electrical and pneumatic actuation systems.
- To learn the concepts of digital communications and develop PLC programs.
- To evaluate the performance of mechatronic systems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Remembering the theories about various types of sensors and transducers.
[CO2]Understanding the various mechanical, electrical and pneumatic actuation systems.
[CO3]Evaluating the basic mathematical building blocks for mechanical, electrical, thermal and fluid actuation system and its interfacing of input/output requirements.
[CO4] Applying Knowledge of mechatronics in proper selection of sensor and transducer for specific purpose.
[CO5]Creating curiosity to learn new development in the field of mechatronics.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronic approach, Integrated Product Design, open and closed loop control.Modeling, Analysis and Simulation, Man- Machine Interface.Automatic Control and Real Time Control Systems.Examples :Automatic water level controller; Sequential controllers-washing machine.

SENSORS AND TRANSDUCERS: Classification: Displacement, Position & Proximity Sensors; Velocity and Motion Sensors; Force Sensors; Fluid Pressure Sensors; Flow Sensors;

Liquid Level Sensors; Temperature Sensors; Light Sensors; Selection of Sensors.Development in Transducer technology, Opto-electronics- Shaft encoders, CD Sensors, Vision System, etc.

DRIVES AND ACTUATORS: Mechanical ActuationSystemsTypes of motion; Freedom and constraints; Loading; Gear Trains; Pawl & Ratchet; Belt & Chain drives; Bearings: Selection, Ball & Roller bearings; Mechanical aspects of motor selection.Pneumatic&HydraulicSystems:Power supplies; DCV; PCV; Cylinders; Rotary actuatorsElectrical Actuation Systems:Switches& Relays; Solenoids; D.C Motors; A.C.Motors; Stepper Motors: Specifications and Control of stepper motors; Servomotors: D.C Servomotor and A.C Servomotor

MATHEMATICAL MODEL AND PLC PROGRAMMING:Mathematical Model: Introduction to Mathematical model; Mechanical System building blocks; Electrical System building blocks; Fluid System building blocks; Thermal System building blocksInput/OutputSystems:Interfacing; Input/output ports; Interface requirements: Buffers, Handshaking, Polling and interrupts, Serial interfacing; Introduction to PIA; Serial communications interface; Example of interfacing of a seven-segment display with a decoder.Programmable Logic Controller (PLC**):** Definition; Basic block diagram and structure of PLC; Input/Output processing; PLC Programming: Ladder diagram, its logic functions, Latching and Sequencing; PLC mnemonics; Timers; Internal relays and Counters; Shift registers; Master and Jump Controls; Data handling; Analog input/output; Selection of PLC

ADVANCED APPLICATIONS IN MECHATRONICS: Traditional Vs Mechatronics designs; Case studies of Mechatronics systems, pick-and-place robot, Car park barrier, Car engine management system, Automatic Camera and Automatic Washing Machine.Micromechatronic systems: Micro sensors, Micro actuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.

E. TEXT BOOKS

T1. Mechatronics W. Bolton, Pearson Education, Asia 2007
T2. A Text Book on Mechatronics, R. K. Rajput, S. Chand & Co, New Delhi 2011
T3. K.S. Fu., R.C.Gonalez, C.S.G.Lee, " Robotics Control sensing ", Vision and Intelligence, McGrawHill International Edition, 1987.
T4. M. P. Groover, "Industrial Robotics – Technology, Programming and Applications", Mc-Graw-Hill, 2001

F. REFERENCE BOOKS

R1. Fu. K. S. Gonzalz. R. C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence",McGraw-Hill Book Co., 1987
R2. YoramKoren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
R3. Janakiraman. P. A., "Robotics and Image Processing", Tata McGraw-Hill, 1995
R4. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Remembering the theories about various types of sensors and transducers.	3		2		2											
[CO2]	Understanding the various mechanical, electrical and pneumatic actuation systems.	3		2													
[CO3]	Evaluating the basic mathematical building blocks for mechanical, electrical, thermal and fluid actuation system and its interfacing of input/output requirements.	3		2		2											
[CO4]	Applying Knowledge of mechatronics in proper selection of sensor and transducer for specific purpose.	3															
[CO5]	Creating curiosity to learn new development in the field of mechatronics.	3		1		2											

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Subject: Total Quality Management

Code: BTE26375

3 Credits | Semester VI

A. INTRODUCTION: This course facilitate the understanding of total quality management principles and processes used in industries.

B. COURSE OUTCOMES :

[CO1] Remembering the different principles of quality control.
[CO2] Understanding the role and responsibilities of a quality engineer.
[CO3] Analyzing different tools used for quality checkup.
[CO4] Evaluating the tools used in quality control using numerical problems.
[CO5] Creating curiosity to learn newly adopted quality control tools.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction: need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention; costs to quality.

TQM principles: leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement; PDCE cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.

The seven traditional tools of quality: New management tools; Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; FMEA- stages, types.

TQM tools and techniques: control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function; TPM- concepts, improvement needs, performance measures.

Quality systems: need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation,; Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits; TQM implementation in manufacturing and service sectors

E.TEXT BOOKS:

1. Besterfield D.H. et al., Total quality Management, 3rd ed., Pearson Education Asia, 2006.
2 Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian edition, Cengage Learning, 2012.

E. REFERENCE BOOKS:

1. Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.
2. Suganthi L. and Samuel A., Total Quality Management, Prentice Hall India, 2006.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Remembering the different principles of quality control.	**3**					**2**			**2**		**2**					
[CO2]	Understanding the role and responsibilities of a quality engineer.	**2**					**2**									**2**	
[CO3]	Analyzing different tools used for quality checkup.	**2**															**2**
[CO4]	Evaluating the tools used in quality control using numerical problems.	**2**															**2**
[CO5]	Creating curiosity to learn newly adopted quality control tools.	**2**															

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Subject: Composite Materials

Code: BTE26168

3 Credits | Semester VI

A. Introduction:

- To understand the mechanical behaviour of composite materials
- To get an overview of the methods of manufacturing composite materials
- To obtain knowledge on classification, processing, characterization and applications of composite materials.
- To obtain knowledge on mechanical properties and failure mechanisms of composites under loading conditions for engineering applications

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understanding an overview of the mechanical behaviour and application of composite materials

[CO2]Remembering the knowledge on classification, processing, characterization of various composite materials.

[CO3]Analyzing difference between composite materials and other available engineering materials.

[CO4] Evaluating metallurgical changes in composite materials from its parent material.

[CO5]Creating learning habits to know more about new development in the field of composite materials.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Definition, history, characteristics, classifications, advantages and limitations, industrial scenario and applications.Fibers-glass, carbon, ceramic and aramid fibers; Matrices-polymer, graphite, ceramic and metal matrices

MATERIAL AND MICROSTRUCTURAL PARAMETERS OF COMPOSITES: Unidirectional-fibre composites: Fibre characteristics. Longitudinal strength and modulus of composites, minimum and critical fibre volume fractions, factors affecting strength. Transverse strength and modulus.Microstructure of composites, grains , inter-grainular structure.

FAILURE MODES IN COMPOSITES: Single and multiple fractures. Short-fibre composites: Stress transfer, critical fibre length. Modulus and strength. Whiskers and whisker reinforced composites. Determination of lamina stresses, maximum stress and strain criteria, von Mises Yield criterion for isotropic materials generalized Hill’s criterion for anisotropic materials, Tsai-Hill’s criterion for composites, prediction of laminate failure, thermal analysis of composite laminates.

MANUFACTURING OF COMPOSITES:ParticulatecompositesLarge-particle composites and dispersion-strengthened composites. Cermets. Zirconia toughened ceramics. Interface: Interface characteristics and their effects on adhesive, frictional and mechanical bonding mechanisms. Coupling agents and their role on the properties composites. Interface coatings. manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes.

PROPERTIES OF COMPOSITES: Static mechanical properties, fatigue, impact and creep properties, fracture behaviour and damage tolerance.Macroscopic viewpoint, generalized Hookes law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

ADVANCED COMPOSITES: Nan composites, hybrid composites, sandwich composites, in-situ composites. smart composites, self-healing composites, and carbon-carbon composites.

E. TEXT BOOKS

T1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.

F.REFERENCE BOOKS

R1. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill, 1998.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PSO 4
[CO1]	Understanding an overview of the mechanical behaviour and application of composite materials	**2**		**2**			**2**								**2**		
[CO2]	remembering the knowledge on classification, processing, characterization of various composite materials.	**2**		**1**											**2**		
[CO3]	Analyzing difference between composite materials and other available engineering materials.	**2**		**1**											**2**		
[CO4]	Evaluating metallurgical changes in composite materials from its parent material.	**3**		**1**			**2**								**1**		
[CO5]	Creating learning habits to know more about new development in the field of composite materials.	**2**													**1**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Subject: Organizational Behavior

Code: BTE24060

3 Credits | Semester VI

A. Introduction:

- What students are expect to learn at the end of the course?

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the dynamics of human behaviour in work context.
[CO2]Understand the determinants of work behaviour from different levels.
[CO3]Develop competencies of analyzing behavioral issues in the work environment
[CO4] Expose students to key ideas and issues in OB that influence the way people behave in organizational setting

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Study of OB: Definition, Meaning, Why Study OB.Learning- Nature of Learning, How learning occurs, Learning and OB.

INDIVIDUAL BEHAVIOUR & MOTIVATION: Foundations of Individual Behaviour: Personality- Meaning and Definition, Determinants o Personality, Personality Traits, Personality and OB.Perception- Meaning and Definition, Perceptual Process, Importance of Perception in OB.Motivation- Nature and Importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.

ORGANISATIONAL BEHAVIOUR PROCESSES: Communication- Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving interpersonal effectiveness.Groups in Organisations- Nature, Types, Why do people join groups , Group cohesiveness and Group Decision making. Managerial Implications, Effective Team building.

LEADERSHIP & CONFLICT MANAGEMENT:Leadership & Management, Theories of leadership- Trait theory, Leader, Behaviour theory, Contingency Theory, Leadership, Leadership and Followership, How to be an effective leader**.**Conflict- Nature of Conflict and conflict resolution.An introduction to transactional analysis

ORGANISATION CULTURE & HRM: Organisational Culture- Meaning & Definition, Culture and Organisational effectiveness**.**Introduction to Human Resource Management- Selection, Orientation, Training& Development, Performance Appraisal, Incentives.Organisational Changes- Importance of Change, Planned Change and OB techniques.International Organisational Behaviour- Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in global perspective.

E. TEXT BOOKS

T1.Keith Davis, Organizational Behavior, McGraw Hill
T2.K.Aswathappa, Organizational Behavior, Himalaya Publishing House

F. REFERENCE BOOKS

R1.Stephen P. Robbins, Organizational Behavior, Prentice Hall of India

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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	PS O 2	PSO 3	PSO 4
[CO1]	Understand the dynamics of human behaviour in work context.									**2**	**2**	**2**	**2**				**2**
[CO2]	Understand the determinants of work behaviour from different levels.									**2**	**2**	**2**					**2**
[CO3]	Develop competencies of analyzing behavioral issues in the work environment									**3**	**3**		**2**				**2**
[CO4]	Expose students to key ideas and issues in OB that influence the way people behave in organizational setting									**2**	**2**						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Subject: Mechanical Software (Solid Works)

Code: BTE25125

1 Credits | Semester VI

A. Introduction:

- To make students familiar with at least one design software.
- To understand various tools used in designing.
- To make 3-D design of basic mechanical components.

B. **Course Outcomes:** At the end of the course, students will be able to

[CO1] Understand 2-D and 3-D modeling using different software tools.
[CO2] Applying basic knowledge of design to convert into solid modeling.
[CO3]Analysing various metal forming operation by simulation.
[CO4] Creating assembly drawing of mechanical components.
[CO5] Remembering various drawing tools and their specific use.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	**Name of Experiment**
1	To practice 2-D scatcher.
2	To practice 3-D modelling.
3	To practice Sheet metal operations.
4	To practice assembly drawing.
5	To practice drafting in 2-D design.
6	To practice how to save, open, edit files.

7	To practice to understand work environment tools.
8	To make any one assembly drawing with proper dimension by using geometrical dimension and tolerance.

E. Text Book:

T1.SOLIDWORKS 2018 Quick Start with Video Instruction by David C. Planchard, CSWP
T2.Solidworks 2018 by Gaurav Verma& Matt Weber.

F. Reference Books:
R1.Certified SOLIDWORKS Professional Advanced Preparation Materials by Paul Tran CSWE, CSWI

F. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand 2-D and 3-D modeling using different software tools.	**2**	**3**	**2**	**2**	**3**								**3**	**2**		**2**
[CO2]	Applying basic knowledge of design to convert into solid modeling.	**2**	**3**	**2**	**2**	**2**								**3**	**2**		
[CO3]	Analysing various metal forming operation by simulation.	**2**	**2**	**2**		**3**								**3**	**2**		**2**
[CO4]	Creating assembly drawing of mechanical components.	**2**	**3**		**2**	**2**								**3**	**2**		**2**
[CO5]	Remembering various drawing tools and their specific use.	**2**	**3**		**2**	**3**								**3**	**2**		**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Subject: Manufacturing Process-II Lab

Code:BTE26302

1 Credits | Semester VI

A. Introduction:

- To identify and understand the types of machine tools.
- To select the appropriate machine tool for specific task.
- To understand the effect of different elements of cutting tool geometry.
- To learn the parts and components of machine tool.
- To learn the concept of maintenance of machine tools.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Identify the various machine tools and form generated by them.
[CO2]Understand the various parts of cutting tools, single point,multi-point cutting tool.
[CO3]Correctly select the machine tool for specific purpose.
[CO4] Understand the components, mechanism of motion and power transmission in machine tool.
[CO5] Understand the various concepts of maintenance of machine tools.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiment
1	Study of milling and conventional lathe machine.
2	Study of shaper machine.
3	To perform straight and taper turning in engine lathe.
4	To perform thread cutting in engine lathe.
5	To perform slitting operation in horizontal milling machine.
6	To make rectangular slot on shaper machine.
7	To perform drilling and tapping operation using drill machine and tapping tool.

8	Overhauling and preventive maintenance of engine lathe.
9	To perform surface grinding operation and measurement of surface roughness.
10	To conduct tool grinding on

E. Text Book:

T1. Elements of Workshop Technology (Volume I & II) – HajraChowdry&Bhattacharaya, Media Promoters, 11th Edition, 2007
T2. Introduction of Basic Manufacturing Processes and Workshop Technology – Rajendersingh, New age International (P) Ltd. NewDelhi, 2006
T3. Workshop Technology – Raghuwanshi, Khanna Publishers. Jain &Gupta, New Delhi, 2002
T4. Production Technology – Jain & Gupta, Khanna Publishers, New Delhi, 2006.
T5. Production Technology – HMT, 18th edition, Tata McGraw Hill, New Delhi
T6. Manufacturing process – Myro N Begman, 5 th edition, Tata McGraw Hill, New Delhi

F. Reference Books:

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3	PSO 4
[CO1]	Identify the various machine tools and form generated by them.	**3**	**2**							**2**					**3**		**2**
[CO2]	Understand the various parts of cutting tools , single point , multi point cutting tool.	**3**								**2**					**3**		**2**
[CO3]	Correctly select the machine tool for specific purpose.	**3**	**2**							**2**					**3**		**2**
[CO4]	Understand the components , mechanism of motion and power transmission in machine tool.	**3**	**2**							**2**					**3**		**2**
[CO5]	Understand the various concepts of maintenance of machine tools.	**3**								**2**					**3**		**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Subject: Refrigeration & Air Conditioning Lab

Code: BTE26172

1 Credits | Semester VI

A. Introduction:

- To Identify various components of refrigeration and air conditioning equipment
- To analyze cooling load based on application.
- To interpret psychometric chart to find various properties of air.
- To observe working of test rigs and calculate coefficient of performance.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understanding types, working principles and construction of Refrigeration and Air Conditioning systems.
[CO2]Evaluating performance of refrigeration and air conditioning system
[CO3]Enlist properties of refrigerants, their applications and effects on environment.
[CO4] Remembering various components and controls used in refrigeration and air conditioning
[CO5] Estimate cooling and heating loads in refrigeration and air conditioning.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiment
1	Trial on water cooler test rig.
2	Demonstration of domestic refrigerator in View of construction, operation and controls used.
3	Demonstration of various controls like L.P./H.P. cut outs, thermostat, overload protector, solenoid valve used in RAC
4	Trial on vapour compression refrigeration test rig.

5	Trial on vapour absorption refrigeration system test rig.
6	Cooling load calculations for cabin, classrooms, laboratory, canteen and dairy plant, milk storage, small freezers (minimum one).
7	Trial on A.C. test rig.
8	Trouble shooting of domestic refrigerator/window air- Conditioner.

E. Text Book:

T1. Refrigeration and Air Conditioning, C.P. Arora, TMH
T2. Refrigeration and Air Conditioning, Sadhu Singh, Khanna Publishing House
T3. A Course in Refrigeration & Air Conditioning, Domkundwar, DhanpatRai .

F. Reference Books:

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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	PS O 3	PSO 4
[CO1]	Understanding types, working principles and construction of Refrigeration and Air Conditioning systems.	**3**								**2**							**2**
[CO2]	Evaluating performance of refrigeration and air conditioning system	**2**															**3**
[CO3]	Enlist properties of refrigerants, their applications and effects on environment.	**2**						**2**		**2**							**2**
[CO4]	Remembering various components and controls used in refrigeration and air conditioning	**3**						**2**		**2**							**2**
[CO5]	Estimate cooling and heating loads in refrigeration and air conditioning.	**2**						**2**									**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial

Syllabus of

B.Tech. in Mechanical Engineering

Semester-VII

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME
Scheme of Study (w.e.f Batch 2020-21)

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes Lab-I	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Summer Internship –I (3-4 week)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronic Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II –(4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:
AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):
Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.
The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.
Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.
Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Subject: Automation in Manufacturing

Code: BTE27320

3 Credits | Semester VII

A. Introduction:

- To understand the importance of automation in the of field machine tool based manufacturing
- To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC
- To understand the basics of product design and the role of manufacturing automation

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the concept and types of automation
[CO2]Assessment of degree and level of automation
[CO3]Justification of automation.
[CO4]To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC
[CO5] Understanding transfer lines and advanced industrial automation.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Why automation, Current trends, CAD, CAM, CIM; Rigid automation: Part handling, Machine tools.Flexible automation: Computer control of Machine Tools and Machining Centers, NC and NC part programming. NC-Adaptive Control, Automated Material handling. Assembly, Flexible fixturing.

COMPUTER AIDED DESIGN: Fundamentals of CAD - Hardware in CAD-Computer Graphics Software and Data Base.Geometric modeling for downstream applications and analysis methods.Computer Aided Manufacturing: CNC technology, PLC, Micro-controllers, CNC-Adaptive Control.

LOW COST AUTOMATION: Mechanical& Electro mechanical Systems. Pneumatics and Hydraulics. Illustrative Examples and case studies.

INTRODUCTION TO MODELING AND SIMULATION:Product design, process route modeling.Optimization techniques.Case studies & industrial applications.

AUTOMATED MANUFACTURING SYSTEMS: Components of Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme.Single Station Manned Workstations and Single Station Automated Cells

E. TEXT BOOKS

T1.Mikell P. Groover, Automation, Production Systems, and Computer-integrated Manufacturing, prentice Hall
T2.SeropeKalpakjian and Steven R. Schmid, Manufacturing – Engineering and Technology, 7th edition,Pearson

F. REFERENCE BOOKS

R1.YoramKoren, Computer control of manufacturing system, 1st edition
R2.Ibrahim Zeid, CAD/CAM: Theory & Practice, 2nd edition.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Understand the concept and types of automation	**2**	**1**			**2**											
[CO2]	Assessment of degree and level of automation	**2**	**2**		**1**										**2**		
[CO3]	Justification of automation.				**2**												
[CO4]	To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC	**1**				**2**								**2**			**1**
[CO5]	Understanding transfer lines and advanced industrial automation.						**1**										

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Computer Aided Design

Code: BTE27376
3 Credits | Semester VII

A. Introduction:

- To provide an overview of how computers can be utilized in mechanical component design

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Students will understand the role of CAD in mechanical component and system design by creating geometric models and engineering drawings
[CO2]Students will understand the basic mathematics fundamental to CAD software
[CO3]Students will work in teams to design a mechanical system and fabricate a prototype of their design
[CO4] Upon completion of this course, the students can use computer and CAD software for modeling mechanical components.
[CO5] Design and analysis of engineering components.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FUNDAMENTALS OF COMPUTER GRAPHICS: Product cycle, sequential and concurrent engineering,Computer Aided Design.CAD system architecture, computer graphics, Coordinate systems.2D and 3D transformations, viewing transformation.

GEOMETRIC MODELING: Representation of curves, Hermite curves, Bezier curves, B-spline curves, rational curves.Techniques of surface modelling, surface patch, Coons and bicubic patches, Bezier and B-spline surfaces.Solid modelling techniques, CSG and B-rep

VISUAL REALISM: Hidden line-surface-solid removal algorithms**.** Shading, Coloring, Computer Animation.

ASSEMBLY OF PARTS:Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, mechanism simulation and interefencechecking.CAD standards- Graphical Kernel System (GKS), standards for vexchange images, Open Graphics Library (OpenGL), Data exchange standards- IGES, STEP, CALS etc., and Communication standards.

FINITE ELEMENT ANALYSIS: Review of stress-strain relation and generalized Hooke's Law, Plane stress and Plane strain conditions; Concept of Total Potential Energy.Basic procedure for solving a problem using Finite Element Analysis.

E. TEXT BOOKS

T1.Ibrahim Zeid, Mastering CAD CAM, Tata McGraw Hill Publishing Co. 2007.
T2.C. McMohan and J. Browne, CAD/CAM Principles, II edition, Pearson Education, 1999.

F. REFERENCE BOOKS

R1. W. M. Neumann and R.F. Sproul, Principles of Computer Gra[hics, McGraw Hill, 1989.
R2. D. Hearn and M.P> Baker, Computer Graphics, Prentice Hall Inc., 1992.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Students will understand the role of CAD in mechanical component and system design by creating geometric models and engineering drawings	**2**												**3**			
[CO2]	Students will understand the basic mathematics fundamental to CAD software	**2**															
[CO3]	Students will work in teams to design a mechanical system and fabricate a prototype of their design			**3**													
[CO4]	Upon completion of this course, the students can use computer and CAD software for modeling mechanical components.					**2**											
[CO5]	Design and analysis of engineering components.			**2**													

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Power Plant Engineering

Code: BTE27211

3 Credits | Semester VII

A. Introduction:

- To provide an overview of power plants and the associated energy conversion issues.
- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.

[CO2]Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.

[CO3]Combine concepts of previously learnt courses to define the working principle of diesel power plant, its layout, safety principles and compare it with plants of other types.

[CO4] Describe the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it.

[CO5] Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

COAL BASED THERMAL POWER PLANTS: Basic Rankine cycle and its modifications, layout of modern coalpowerplant.super critical boilers, FBC boilers, turbines, condensers, steam and heating rates.Subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems.

GAS TURBINE AND COMBINED CYCLE POWER PLANTS: Brayton cycle analysis and optimization, components of gas turbine power plants.combined cycle power plants, Integrated Gasifier based CombinedCycle (IGCC) systems.

BASICS OF NUCLEAR ENERGY CONVERSION: Layout and subsystems of nuclear power plants.BoilingWaterReactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy WaterReactor (PHWR), Fast Breeder Reactors (FBR). Gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

POWER FROM RENEWABLE ENERGY:Hydroelectric power plants, classification, typical layout and components,Principles of wind, Tidal, Solar PV and Solar thermal.Geothermal, Biogas and Fuel cell power systems.

ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES: Power tariffs, Load distribution parameters, Load curve.Capital and Operating cost of different power plants.Pollution control technologies including wastedisposal options for coal and nuclear plants.

E. TEXT BOOKS

T1.Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
T2.El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

F. REFERENCE BOOKS

R1. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PSO 3	PS O 4
[CO1]	Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.	**2**															
[CO2]	Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts.		**2**														
[CO3]	Combine concepts of previously learnt courses to define the working principle of diesel power plant, its layout, safety principles and compare it with plants of other types.		**1**														
[CO4]	Describe the working principle and basic components of the nuclear power plant and the economic and safety principles involved with it.							**1**									

[CO5]	Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.							**1**									

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Finite Element Analysis

Code: BTE27321

3 Credits | Semester VII

A. Introduction:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Summarize the basics of finite element formulation.
[CO2]Apply finite element formulations to solve one-dimensional Problems.
[CO3]Apply finite element formulations to solve two-dimensional scalar Problems.
[CO4] Apply finite element method to solve two-dimensional Vector problems.
[CO5] Apply finite element method to solve problems on iso parametric element and dynamic Problems.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Historical Background, Mathematical Modeling of field problems in Engineering, Governing Equations – Discrete and continuous models.Boundary, Initial and Eigen Value problems, Weighted Residual Methods, Variation Formulation of Boundary Value Problems, Ritz Technique.Basic concepts of the Finite Element Method

ONE-DIMENSIONAL PROBLEMS: One Dimensional Second Order Equations, Discretization, Element types- Linear and Higher order Elements.Derivation of Shape functions and Stiffness matrices and force vectors, Assembly of Matrices, Solution of problems from solid mechanics and heat transfer.Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation, Transverse deflections and Natural frequencies of beams.

TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS: Second Order 2D Equations involving Scalar Variable Functions, Variational formulation, Finite Element formulation, Triangular elements, Shape functions and element matrices and vectors. Application to Field

Problems, Thermal problems, Torsion of Non circular shafts, Quadrilateral elements, Higher Order Elements.

TWO DIMENSIONAL VECTOR VARIABLE PROBLEM:Equations of elasticity,Plane stress, plane strain and ax symmetric problems.Body forces and temperature effects – Stress calculations – Plate and shell elements. Body forces and temperature effects – Stress calculations – Plate and shell elements.

ISOPARAMETRIC FORMULATION: Natural co-ordinate systems, Isoparametric elements , Shape functions for iso parametric elements, One and two dimensions.Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques.Solutions Techniques to Dynamic problems – Introduction to Analysis Software

E. TEXT BOOKS

T1.Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005.

F. REFERENCE BOOKS

R1. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Summarize the basics of finite element formulation.	1															
[CO2]	Apply finite element formulations to solve one-dimensional Problems.		2														
[CO3]	Apply finite element formulations to solve two-dimensional scalar Problems.		2														
[CO4]	Apply finite element method to solve two-dimensional Vector problems.		2														
[CO5]	Apply finite element method to solve problems on iso parametric element and dynamic Problems.		2													2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Gas Dynamics and Jet Propulsion

Code: BTE27212

3 Credits | Semester VII

A. Introduction:

- To understand the features of compressible isentropic flows and irreversibility like shocks.
- To provide a basic knowledge of jet and rocket propulsion technologies.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the basic difference between incompressible and compressible flow.
[CO2]Understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
[CO3]Upon completion of this course, the students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion.
[CO4] Understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
[CO5]Upon completion of this course, the students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BASIC CONCEPTS AND ISENTROPIC FLOWS: Energy and momentum equations of compressible fluid flows – Stagnation states.Compressible flow, definition, Mach waves and Mach cone.Isentropic flow through variable area ducts, nozzle s and diffusers.Subsonic and supersonic flow I variable area ducts, choked flow, Area-Mach numberrelations for isentropic flow

FLOW THROUGH DUCTS: Non-isentropic flow in constant area ducts, Rayleigh and Fanon flows.Variation of flow properties – Use of tables and charts – Generalized gas dynamics.

NORMAL AND OBLIQUE SHOCKS: Governing equations, Variation of flow parameters across the normal and oblique shocks. Prandtl – Meyer relations, Use of table and charts – Applications.

JET PROPULSION: Theory of jet propulsion, thrust equation thrust power and propulsive efficiency. Operating principle and cycle analysis of ramjet. Turbojet, Turbofan and Turboprop engines.

SPACE PROPULSION: Types of rocket engines, propellants & feeding systems, ignition and combustion. Theory of rocket propulsion, performance study. Staging, terminal and characteristic velocity, space flights.

E. TEXT BOOKS

T1.Ahmed F. El-Sayed, Aircraft Propulsion and Gas Turbine Engines, CRC Press, 2008.H.S.
T2.Mukunda, “Understanding Aerospace Chemical Propulsion”, Interline Publishing, 2004.
T3.Hill P. and Peterson C., Mechanics & Thermodynamics of Propulsion, Addison Wesley, 1992.

F. REFERENCE BOOKS

R1.Zucrow N. J., Aircraft and Missile Propulsion, Vol.I& II, John Wiley, 1975.
R2.Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Understand the basic difference between incompressible and compressible flow.	**1**	**1**														
[CO2]	Understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.	**2**															
[CO3]	Upon completion of this course, the students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion.			**2**													
[CO4]	Understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.	**2**															
[CO5]	Upon completion of this course, the students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion.					**2**											

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Sustainable Development

Code: BTE27322

3 Credits | Semester VII

A. Introduction:

- To impart knowledge on the principles for balancing social, economic and environmental dimensions of development and the associated international and national frameworks.
- Appreciate some of the scientific underpinnings of sustainability practice and how policymakers are trying to apply it for better governance of scarce resources.
- Gain additional scientific knowledge regarding planetary boundaries and their influence on international economic development.

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Describe the national and global environmental, economic and social issues and the principles of different sustainable development frameworks

[CO2]Apply the sustainable development principles during the planning of developmental activities.

[CO3]Understand the practice and policy of sustainable pathways to development.

[CO4] Understand how development leaders can apply various attributes of sustainability (environmental, economic and social).

[CO5] Be aware of the current international policy landscape for the Sustainable Development Goals.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Status of environment, Environmental, Social and Economical issues, Need for sustainability.Ways to achieve sustainability – population, resources, development, and environment.

CHALLENGES OF SUSTAINABLE DEVELOPMENT: Concept of sustainability, Factors governing sustainable development.Linkages among sustainable development

GLOBALENVIRONMENTAL ISSUES: Environment and poverty, Population, income and urbanization. Health care, Food, fisheries and agriculture. Materials and energy flows

SUSTAINABLE DEVELOPMENT INDICATORS: Need for indicators, Statistical procedures.Aggregating indicators, Use of principal component analysis.Three environmental quality indices.

CURBING CLIMATE CHANGE: Introduction to the science of climate change.Interactionbetween the environment and human health

E. TEXT BOOKS

T1.Sayer, J. and Campbell, B., "The Science of Sustainable Development: Local Livelihoods and the Global Environment" (Biological Conservation, Restoration &Sustainability), Cambridge University Press, London, 2003.
T2.Kirkby, J., O"Keefe P. and Timberlake, "Sustainable Development", Earth scan Publication, London, 1993.
T3.Peter P. Rogers, Kazi F. Jalal, John A. Boyd, "An introduction to sustainable development", Glen Educational Foundation, 2008.
T4.Jennifer A. Elliott, "An introduction to sustainable development". London: Routledge: Taylor and Francis group, 2001.

B. REFERENCE BOOKS

R1. Low, N. Global ethics and environment. London: Routledge. 1999.
R2. Douglas Muschett, Principles of Sustainable Development, St. Lucie Press, 1997.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Describe the national and global environmental, economic and social issues and the principles of different sustainable development frameworks						**2**	**3**									
[CO2]	Apply the sustainable development principles during the planning of developmental activities.						**2**										
[CO3]	Understand the practice and policy of sustainable pathways to development.						**1**										
[CO4]	Understand how development leaders can apply various attributes of sustainability (environmental, economic and social).							**2**									
[CO5]	Be aware of the current international policy landscape for the Sustainable Development Goals.												**1**				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Internet of Things

Code: BTE27323

3 Credits | Semester VII

A. Introduction:

Students will understand the concepts of Internet of Things and can able to build IoTapplications

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand the concepts of Internet of Things
[CO2]Analyze basic protocols in wireless sensor network.
[CO3]Design IoT applications in different domain and be able to analyze their performance.
[CO4] Implement basic IoT applications on embedded platform
[CO5] Application of IoT in automation of Commercial and Real world examples

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO IOT: Defining IoT, Characteristics of IoT, and Physical design of IoT.Logical design of IoT, Functional blocks of IoT,Communication models &APIs.

IOT & M2M: Machine to Machine, Difference between IoT and M2M.Software define Network

NETWORK & COMMUNICATION ASPECTS: Wireless medium access issues, MAC protocol survey. Survey routing protocols, Sensor deployment & Node discovery. Data aggregation & dissemination.

CHALLENGES IN IOT: Design challenges, Development challenges.Security challenges, other challenges

DOMAIN SPECIFIC APPLICATIONS OF IOT: Home automation, Industry applications.Surveillance applications, Other IoT applications.

E. TEXT BOOKS

T1.Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”

F. REFERENCE BOOKS

R1.WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks:Theory and PracticeElements, John Wiley, New York, 1986.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand the concepts of Internet of Things	**2**															
[CO2]	Analyze basic protocols in wireless sensor network.					**2**											
[CO3]	Design IoT applications in different domain and be able to analyze their performance.			**2**	**2**												
[CO4]	Implement basic IoT applications on embedded platform						**2**										
[CO5]	Application of IoT in automation of Commercial and Real world examples												**2**		**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Cad-Cam Lab

Code: BTE27209

2 Credits | Semester VII

A. Introduction:

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Draw 3D and Assembly drawing using CAD software
[CO2]Demonstrate manual part programming with G and M codes using CAM
[CO3]Design IoT applications in different domain and be able to analyze their performance.
[CO4] Creating 3 D Model on any CAD software like Pro/E, UG, CATIA, etc.
[CO5] Developing any four part programs lathe and milling operations

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

S.No.	Name of Experiment
1	Introduction of 3D Modeling software
2	Creation of 3D assembly model of following machine elements using 3D Modelling software: a) Flange Coupling b) Plummer Block c) Screw Jack d) Lathe Tailstock e) Universal Joint f) Machine Vice

	g) Stuffing box h) Crosshead i) Safety Valves
3	Creation of 3D assembly model of following machine elements using 3D Modelling software: j) Flange Coupling k) Plummer Block l) Screw Jack m) Lathe Tailstock n) Universal Joint o) Machine Vice p) Stuffing box q) Crosshead r) Safety Valves s) Non-return valves t) Connecting rod u) Piston v) Crankshaft
4	Part Programming – Cnc Machining Centre a) Linear Cutting. b) Circular cutting. c) Cutter Radius Compensation. d) Canned Cycle Operations.
5	Part Programming – Cnc Turning Centre a) Straight, Taper and Radius Turning. b) Thread Cutting. c) Rough and Finish Turning Cycle. d) Drilling and Tapping Cycle.
6	Computer Aided Part Programming a) CL Data and Post process generation using CAM packages. Application of CAPP in Machining and Turning Centre

D. Text Book:

E. Reference Books:

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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	PS O 2	PS O 3	PS O 4
[CO1]	Draw 3D and Assembly drawing using CAD software													**3**			
[CO2]	Demonstrate manual part programming with G and M codes using CAM	**1**	**2**														**3**
[CO3]	Design IoT applications in different domain and be able to analyze their performance.		**2**														
[CO4]	Creating 3 D Model on any CAD software like Pro/E, UG, CATIA, etc.					**3**											
[CO5]	Developing any four part programs lathe and milling operations			**2**													

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject:Summer Internship-II

Code: BTE27349

3 Credits | Semester VII

A. Introduction:

- Following are the intended objectives of internship training:
- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be use in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job

B. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	30
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

GUIDELINES FOR INTERNSHIP

Summer Internship –II should be undertaken in an industry only

S.No.	Suggested Schedule	Suggested Duration (In weeks)	Activities
1	Summer/winter vacation after 4th Semester	4-6	Inter/Intra Institutional Activities

Subject:Minor Project

Code: BTE27348

3 Credits | Semester VII

A. Introduction: The objective of this course is to prepare students to use applications of the theory and practical learned during the course. It will also help students to develop an industry or research oriented project. This course helps students how to carry out project/studies in the field of interest of the student or as given by the industry.

B.Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	30
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

GUIDELINES FOR PROJECT

Minor Project should be based on real/ live problems of the Industry/Govt./NGO/ MSME/Rural Sector or an innovative idea having the potential of a Startup and this project to be carried over to next semester.

ARKA JAIN University Jharkhand

Syllabus of

B.Tech. in Mechanical Engineering

Semester-VIII

SEMESTER –I

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–I	A & B	3-1-0	4
2	Engineering Chemistry	A	3-0-0	3
	Programming for Problem Solving	B	3-0-0	3
3	Basic Electrical Engineering	A	3-1-0	4
	Engineering physics	B	3-1-0	4
4	Engineering Mechanics	A	3-0-0	3
	English for Communication	B	3-0-0	3
5	Constitution of India	B	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	A	0-0-1	1
	Engineering Physics Lab	B	0-0-1	1
7	Basic Electrical Engineering Lab	A	0-0-1	1
	Programming for Problem Solving Lab	B	0-0-2	2
8	Engineering Mechanics Lab	A	0-0-1	1
9	Engineering Graphics & Design	A	0-0-2	2
	Workshop Practices	B	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –II

Sr. No.	Name of the Subject	Group	L-T-P	Credit
1	Engineering Mathematics–II	A & B	3-1-0	4
2	Engineering Chemistry	B	3-0-0	3
	Programming for Problem Solving	A	3-0-0	3
3	Basic Electrical Engineering	B	3-1-0	4
	Engineering physics	A	3-1-0	4
4	Engineering Mechanics	B	3-0-0	3
	English for Communication	A	3-0-0	3
5	Constitution of India	A	0-0-0	0
	Practical			
6	Engineering Chemistry Lab	B	0-0-1	1
	Engineering Physics Lab	A	0-0-1	1
7	Basic Electrical Engineering Lab	B	0-0-1	1
	Programming for Problem Solving Lab	A	0-0-2	2
8	Engineering Mechanics Lab	B	0-0-1	1
	Engineering Graphics& Design	B	0-0-2	2
9	Workshop Practices	A	0-0-2	2
	TOTAL	A or B	12-2-5	19

SEMESTER –I (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–I	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER I (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –I	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER II (Group-A)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering physics	BSC	4	4	100	70	20	5	5
2	Engineering Mathematics –II	BSC	4	4	100	70	20	5	5
3	Programming for Problem Solving	ESC	3	3	100	70	20	5	5
4	English for Communication	HSMC	3	3	100	70	20	5	5
5	Constitution of India	MC	0	2	50	35	10	2.5	2.5
	Practical								
6	Engineering physics Lab	BSC	1	2	50	35	5	5	5
7	Programming for Problem Solving Lab	ESC	2	4	50	35	5	5	5
8	Workshop Practices	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**26**	**600**	**420**	**105**	**37.5**	**37.5**

SEMESTER –II (Group-B)

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA*	Attendance
1	Engineering Chemistry	BSC	3	3	100	70	20	5	5
2	Engineering Mathematics–II	BSC	4	4	100	70	20	5	5
3	Basic Electrical Engineering	ESC	4	4	100	70	20	5	5
4	Engineering Mechanics	ESC	3	3	100	70	20	5	5
	Practical								
5	Engineering Chemistry Lab	BSC	1	2	50	35	5	5	5
6	Basic Electrical Engineering Lab	ESC	1	2	50	35	5	5	5
7	Engineering Mechanics Lab	ESC	1	2	50	35	5	5	5
8	Engineering Graphics& Design	ESC	2	4	50	35	5	5	5
	TOTAL		**19**	**24**	**600**	**420**	**100**	**40**	**40**

SEMESTER-III

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Strength of Materials	PCC	4	4	100	70	20	5	5
2	Engineering Mathematics -III	BSC	4	4	100	70	20	5	5
3	Basic Electronics Engineering	ESC	3	3	100	70	20	5	5
4	Material Science	ESC	3	3	100	70	20	5	5
5	Thermodynamics	PCC	4	4	100	70	20	5	5
6	Environmental Science	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Strength of Materials Lab	PCC	1	2	50	35	5	5	5
8	Basic Electronics Engineering Lab	ESC	1	2	50	35	5	5	5
9	Machine Drawing Lab	PCC	2	4	50	35	5	5	5
	TOTAL		**22**	**28**	**700**	**490**	**125**	**42.5**	**42.5**

SEMESTER-IV

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Applied Thermodynamics	PCC	4	4	100	70	20	5	5
2	Fluid Mechanics & Machinery	PCC	4	4	100	70	20	5	5
3	Theory of Machine	PCC	4	4	100	70	20	5	5
4	Mechanical Measurement and Control	PCC	3	3	100	70	20	5	5
5	Biology for Engineers	BSC	3	3	100	70	20	5	5
	Practical								
6	Applied Thermodynamics Lab	PCC	1	2	50	35	5	5	5
7	Fluid Mechanics & Machinery Lab	PCC	1	2	50	35	5	5	5
8	Theory of Machine Lab	PCC	1	2	50	35	5	5	5
9	Mechanical Measurement and Control lab	PCC	1	2	50	35	5	5	5
	TOTAL		**22**	**26**	**700**	**490**	**120**	**45**	**45**

SEMESTER V

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Heat & Mass Transfer	PCC	4	4	100	70	20	5	5
2	Solid Mechanics	PCC	4	4	100	70	20	5	5
3	Manufacturing Processes-I	PCC	3	3	100	70	20	5	5
4	Design of Machine Element	PCC	3	3	100	70	20	5	5
5	Open Elective –I Humanities I Professional Practice, Law & Ethics	HSMC	3	3	100	70	20	5	5
6	Essence of Indian knowledge Tradition	MC	0	2	50	35	10	2.5	2.5
	Practical								
7	Heat & Mass Transfer Lab	PCC	1	2	50	35	5	5	5
8	Manufacturing Processes Lab-I	PCC	1	2	50	35	5	5	5
9	Design of Machine Element Lab	PCC	2	4	50	35	5	5	5
10	Summer Internship –I (3-4 week)	PROJ	2	0	50	35	15	0	0
	TOTAL		**23**	**27**	**750**	**525**	**140**	**42.5**	**42.5**

SEMESTER VI

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Manufacturing Process -II	PCC	4	4	100	70	20	5	5
2	Refrigeration & Air Conditioning	PCC	4	4	100	70	20	5	5
3	Elective-I Internal Combustion Engines Microprocessors in Automation	PEC	3	3	100	70	20	5	5
4	Elective-II Total Quality Management Mechatronic Systems Composite Materials	PEC	3	3	100	70	20	5	5
5	Open Elective –II Humanities II Organizational Behavior	HSMC	3	3	100	70	20	5	5
	Practical								
6	Mechanical Software (Solid Works)	PCC	1	2	50	35	5	5	5
7	Manufacturing Process – II Lab	PCC	1	2	50	35	5	5	5
8	Refrigeration & Air Conditioning Lab	PCC	1	2	50	35	5	5	5
	TOTAL		**20**	**23**	**650**	**455**	**115**	**40**	**40**

SEMESTER VII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Automation in Manufacturing	PCC	3	3	100	70	20	5	5
2	Elective III Computer Aided Design Power Plant Engineering	PEC	3	3	100	70	20	5	5
3	Elective-IV Finite Element Analysis Gas Dynamics and Jet Propulsion	PEC	3	3	100	70	20	5	5
4	Open Elective- III Sustainable Development Internet of Things	OEC	3	3	100	70	20	5	5
	Practical								
5	CAD-CAM Lab	PCC	2	4	50	35	5	5	5
6	Minor Project	PROJ	3	6	100	70	30	0	0
7	Summer Internship –II – (4-6 Week)	PROJ	3	0	100	70	30	0	0
	TOTAL		**20**	**20**	**650**	**455**	**145**	**25**	**25**

SEMESTER VIII

S.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Elective V Energy Conservation and Management Process Planning and Cost Estimation Principles of Management	PEC	3	3	100	70	20	5	5
2	Elective VI Automobile Engineering Design of Transmission Systems	PEC	3	3	100	70	20	5	5
3	Open Elective-IV Artificial Intelligent & Machine Learning Cyber Security Laws , Standards & IPR	OEC	3	3	100	70	20	5	5
4	Open Elective-V Renewable Energy Technologies Project Management	OEC	3	3	100	70	20	5	5
	Practical								
5	Major Project	PROJ	8	16	200	140	60	0	0
6	Extra- Curricular/ Co-Curricular Activity	PROJ	0	0	100	70	30	0	0
	TOTAL		**20**	**28**	**700**	**490**	**170**	**20**	**20**

Distribution of Credit across 8 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Humanities and Social Sciences including Management courses **(HSMC)**	3	9
2	Basic Science courses**(BSC)**	8	24
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)**	11	25
4	Professional core courses (**PCC)**	26	64
5	Professional Elective courses relevant to chosen specialization/branch**(PEC)**	6	18
6	Open subjects – Electives from other technical and /or emerging subjects (**OEC)**	3	9
7	Project work, seminar and internship in industry or elsewhere**(PROJ)**	5	16
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)**	3	0
	Total	65	165

CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester

Note:

AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE & IT before commencement of classes

ARKAJAIN University, Jharkhand
School of Engineering & IT
Department of Engineering
Faculty – B.Tech - ME

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyse experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools..

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Subject: Energy Conservation and Management

Code: BTE28252

3 Credits | Semester VIII

A. Introduction:

- To understand the energy data from industries and carry out energy audit for energy savings

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand and analyze the energy data of industries
[CO2] Carryout energy accounting and balancing
[CO3] Conduct energy audit and suggest methodologies for energy savings and
[CO4] utilize the available resources in optimal ways

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Introduction to energy & power scenario of world, National Energy consumption data, environmental aspects associated with energy utilization.Energy Auditing-need, types, methodology and barriers, role of energy managers, instruments of energy auditing

COMPONENT: Components of EB billing, HT and LT supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics.Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux, Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.

THERMAL SYSTEMS: Thermal systems, Boilers, Furnaces and Thermic Fluid heaters-efficiency computation and energy conservation measures.Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories.

ENERGY: Energy conservation in major utilities; pumps, fans, blowers, compressed air systems.Refrigeration& Air Conditioning systems, Cooling Towers, DG sets

ENERGY: Energy Economics- discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept.

E. TEXT BOOKS

T1. Witte L.C. , Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization, Hemisphere Publ., Washington, 1988..

T2. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.

F. REFERENCE BOOKS

R1. Murphy W.R. and McKay G., Energy Management, Butterworths, Lond

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Understand and analyse the energy data of industries	3		2												1	2
[CO2]	Carryout energy accounting and balancing						3	2									2
[CO3]	Conduct energy audit and suggest methodologies for energy savings.	2			2												1
[CO4]	Utilise the available resources in optimal ways	3		2										1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Process Planning and Cost Estimation

Code: BTE27213

3 Credits | Semester VIII

A. Introduction:

- To introduce process planning concepts to make cost estimation for various products

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Upon completion of this course, the students will be able to use the concepts of process planning and cost estimation for various products

[CO2]Describe the functions of production control, various production system, different aspects of product development and break even analysis.

[CO3]Perform the analysis of problems in lack of product planning, quantity determination in batch production and analysis of process capabilities in a multi product system.

[CO4]Calculate the economic order quantity & economic lot size in inventory control.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Introduction of Process Planning- methods of process planning, drawing interpretation.Material evaluation, steps in process selection, production equipment and tooling selection

PROCESS PLANNING:Process planning activities- process parameter calculation for various production processes, selection of jigs and fixtures.selection of quality assurance methods, documents for process planning, economics of process planning, case studies

INTRODUCTION: Introduction to cost estimation- importance of costing and estimation, methods of costing, elements of cost estimation.types of estimates, estimating procedure, estimation of labor cost, material cost,allocation of overhead charges, calculation of depreciation cost.

MACHINING: Machining time estimation- importance of machine time calculation, machining time for different lathe operations, drilling and boring time calculations.Machining time calculation for Milling, Shaping, Planning and Grinding.

PRODUCTION: Production costs- different production processes for different jobs, estimation of forging cost,estimation of welding cost, estimation of foundry cost, estimation of machining cost

E. TEXT BOOKS

T1. Peter Scalon, Process Planning, Design/ Manufacture Interface, Elsevier Sci.&Tech. 2002.
T2. Ostwaal P.F. and Munez J., Manufacturing Processes and Systems, 9th ed., John Wiley 1998.

F. REFERENCE BOOKS

R1. Chitale A.V. and Gupta R.C., Product Design and Manufacturing, 2nd ed., Prentice Hall 2002.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Upon completion of this course, the students will be able to use the concepts of process planning and cost estimation for various products	**3**				**2**										**1**	**2**
[CO2]	Describe the functions of production control, various production system, different aspects of product development and break even analysis.						**3**	**2**									**2**
[CO3]	Perform the analysis of problems in lack of product planning, quantity determination in batch production and analysis of process capabilities in a multi-product system.				**1**							**2**					**1**
[CO4]	Calculate the economic order quantity & economic lot size in inventory control.	**3**		**2**										**1**			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Principles of Management

Code: BTE28377

3 Credits | Semester VIII

A. Introduction:

- To understand the principles of management and their application to the functioning of an organization

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Upon completion of this course, the students will get a clear understanding of management functions in an organization

[CO2]Understand the principles and remember the applications of principles of management related to public and private administration in relation to production activities.

[CO3]Apply human relation skills for motivating the employees.

[CO4]Develop Logical and Analytical ability to apply analyze problems related to production

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

DEFINITION: Definition of management, science or art, manager vs entrepreneur; Types of managers- managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches.Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

NATURE AND PURPOSE:Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management.Planning Tools and Techniques, Decision making steps & processes.

INTRODUCTION: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization. Job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

DIRECTING: Directing, individual and group behavior, motivation, motivation theories, motivational techniques.Jobsatisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

CONTROLLING: Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control.Productivity problems and management, control and Performance, direct and preventive control, reporting.

E. TEXT BOOKS

T1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.
T2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.

F. REFERENCE BOOKS

R1. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PS O 4
[CO1]	Understanding of management functions in an organization	**3**				**3**										**1**	**2**
[CO2]	Understand the principles and remember the applications of principles of management						**2**	**2**									**1**
[CO3]	Apply human relation skills for motivating the employees.											**2**					**1**
[CO4]	Develop Logical and Analytical ability to apply analyze problems related to production activity.	**3**		**2**										**3**			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Automobile Engineering

Code: BTE28249

3 Credits | Semester VIII

A. Introduction:

- To understand the construction and working principle of various parts of an automobile

B. Course Outcomes: At the end of the course, students will be able to

[CO1]Upon completion of this course, students will understand the function of each automobile component and have a clear idea about the overall vehicle performance.
[CO2]Understand the Construction, working and other details about Internal Combustion Engines used in automobiles.
[CO3]Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems.
[CO4]Understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

TYPES OF AUTOMOBILES: Types of automobiles, vehicle construction and layouts, chassis, frame and body, vehicle aerodynamics, IC engines-components, function and materials, variable valve timing (VVT).

ENGINE AUXILIARY SYSTEMS:Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system, transistor based coil ignition & capacitive discharge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

TRANSMISSION SYSTEMS: Transmission systems, clutch types & construction, gear boxes-manual and automatic gearshift mechanisms, over drive, transfer box, flywheel, and torque converter.Propeller shaft, slip joints, universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive.

STEERING GEOMETRY: Steering geometry and types of steering gear box, power steering, types of front axle, types of suspension systems,pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD)and traction control.

ALTERNATIVE ENERGY SOURCES: Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in automobiles, modifications needed, performance, combustion & emission characteristics of alternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells

E. TEXT BOOKS

T1. Kirpal Singh, Automobile Engineering, 7th ed., Standard Publishers, New Delhi, 1997.
T2. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.

F. REFERENCE BOOKS

R1. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999.
R2. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 1	PS O 1	PS O 1
[CO1]	Upon completion of this course, students will understand the function of each automobile component and have a clear idea about the overall vehicle performance.	3				3										1	2
[CO2]	Understand the Construction, working and other details about Internal Combustion Engines used in automobiles.						3	2									1
[CO3]	Identify Construction, working, preventive maintenance, trouble shooting and Diagnosis of various Automobile Systems.											3					1
[CO4]	Understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.	3		3										2			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Design of Transmission Systems

Code: BTE28250

3 Credits | Semester VIII

A. Introduction:

- To learn about the design procedures for mechanical power transmission components

B. Course Outcomes: At the end of the course, students will be able to

[CO1] The students will be able to design transmission systems for engines and machines.
[CO2] To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
[CO3] To understand the standard procedure available for Design of Transmission of Mechanical elements
[CO4] To learn to use standard data and catalogues

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FLEXIBLE TRANSMISSION ELEMENTS: Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets

GEAR TRANSMISSION:Gear transmission- speed ratios and number of teeth, forceanalysis, tooth stresses, dynamic effects, fatigue strength, factor safety, and gear materials.Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverseplane; equivalent number of teeth and forces for helical gears.

STRAIGHT BEVEL GEAR: Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of a pair of straight bevel gears.Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses efficiency.Estimating the size of worm.Gear pair. Cross-helical gears, terminology, helix angles, sizing of a pair of helical gears

GEAR BOX: Gear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box- Design of multi-seed gear box for machine tool applications.Constant mesh gearbox, speed reducer unit; Variable speed gearbox; Fluid couplings, Torque converters for automotive applications.

CAM DESIGN: Cam design, types: pressure angle and undercutting base circle determination, forces and surface stresses.Design of plate clutches, axial clutches, cone clutches, and internal expanding rim clutches; Electromagnetic clutches.Band and Block brakes, external shoe brakes, internal expanding shoe brake.

E. TEXT BOOKS

T1. Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8th ed., Tata McGraw Hill, 2010.
T2. Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley, 2010.

F. REFERENCE BOOKS

R1. Maitra G. and Prasad L., Handbook of Mechanical Design, 2nd ed., Tata McGraw Hill, 2001.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES								
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 1	PS O 1	PSO 1
[CO1]	The students will be able to design transmission systems for engines and machines.	**3**	**3**														**1**
[CO2]	To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.			**2**		**2**											**1**
[CO3]	To understand the standard procedure available for Design of Transmission of Mechanical elements									**2**		**2**					**1**
[CO4]	To learn to use standard data and catalogues											**3**					**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Renewable Energy Technologies

Code: BTE28378

3 Credits | Semester VIII

A. Introduction:

- To expose the student to solar thermal, solar photovoltaic, biomass, wind, small hydro and other renewable energy resources
- To understand conversion technologies, processes, systems and devices and equip the student to take up projects in those areas

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Explain the basic principles of energy conversion processes and devices used therein
[CO2] Identify suitable renewable source and technology for a given requirement.
[CO3] Undertake field projects in these areas
[CO4] Develop capability to do basic design of bio gas plant

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

CLASSIFICATION OF ENERGY: Energy chain and common forms of usable energy - Present energy scenario - World energy status - Energy scenario in India - Introduction to renewable energy resources - Introduction to Solar Energy - Energy from Sun - Spectral distribution of Solar radiation - Instruments for measurement of solar radiation - Solar radiation data analysis

APPLICATIONS OF SOLAR ENERGY:Thermal applications - Introduction to Solar thermal collectors - Types - Principle of operation of different collectors - Flat plate - Evacuated tube collectors - Compound parabolic collectors - Solar air heaters - Solar dryers -solar cookers - solar stills - Solar ponds - concentrating collectors - line type - point type - Methods of Solar power generation - Power towers.

BIO ENERGY SOURCES: Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of a pair of straight bevel gears. Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency.

estimating the size of worm. gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears

WIND ENERGY: Resource assessment - types of wind turbines - selection of components - blade materials - power regulation - various methods of control - wind farms - site selection - off shore wind farms - Solar Wind Hybrid energy systems

OCEAN ENERGY: Power generation through OTEC systems - various types - Energy through waves and tides - Energy generation through geothermal systems – types.

E. TEXT BOOKS

T1. Fang Lin You, Hong ye (2012), Renewable Energy Systems, Advanced conversion technologies and applications, CRC Press
T2.John.A.Duffie, William A.Beckman (2013), Solar Engineering of Thermal processes, Wiley

F. REFERENCE BOOKS

R1. A.R.Jha (2010), Wind Turbine technology, CRC Press.
R2. Godfrey Boyle (2012), Renewable Energy, power for a sustainable future, Oxford University Press.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES								
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O 1**	**PS O 1**	**PS O 1**	**PS O 1**
[CO1]	Explain the basic principles of energy conversion processes and devices used therein	**3**				**3**										**1**	**2**
[CO2]	Identify suitable renewable source and technology for a given requirement.						**3**	**3**									**1**
[CO3]	Undertake field projects in these areas											**3**					**3**
[CO4]	Develop capability to do basic design of bio gas plant	**2**		**3**										**3**			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Project Management

Code: BTE28352

3 Credits | Semester VIII

A. Introduction:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

B. Course Outcomes: At the end of the course, students will be able to

[CO1] Understand key concepts of project management and project lifecycle
[CO2] Apply the Project Management Techniques.
[CO3] Describe the Project Management Planning Process.
[CO4] Project Management Team concepts.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS: Definition of Management – Science or Art – Manager Vs Entrepreneur – types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management.

PLANNING: Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

ORGANISING: Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management

DIRECTING: Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

CONTROLLING: System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting

E. TEXT BOOKS

T1.Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
T2.Robert Kreitner&MamataMohapatra, "Management", Biztantra, 2008.

F. REFERENCE BOOKS

R1. Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
R2. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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 1	PSO 1	PSO 1
[CO1]	Understand key concepts of project management and project lifecycle	**3**	**3**														**1**
[CO2]	Apply the Project Management Techniques.			**2**		**3**											**1**
[CO3]	Describe the Project Management Planning Process.									**2**		**3**					**1**
[CO4]	Project Management Team concepts.											**3**					**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Artificial Intelligent & Machine Learning

Code: BTE28350

3 Credits | Semester VIII

A. Introduction:

- Have a thorough understanding of classical and modern AI applications. Be able to implement a wide range of AI concepts using Prolog. Understand non-classical AI approaches such as genetic algorithms and neural networks. Be able to assess the potential of AI in research and real-world environments

B. Course Outcomes: At the end of the course, students will be able to

[CO 1] Identify problems that are amenable to solution by AI methods.
[CO 2]Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
[CO 3]Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
[CO 4] able to design and implement various machine learning algorithms in a range of real-world applications.
[CO 5] Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: History and foundations of AI, Problem solving: Uninformed and informed Search; Constraint Satisfaction Problems and Constrained Optimization problems (complete and incomplete techniques)

ADVERSARIAL SEARCH: Two players games, games with uncertainty; Decision support systems and technologies, Knowledge representation, Reasoning, Expert systems Contents (2/2), Planning(basics).

MACHINE LEARNING BASICS: Decision trees, Ensemble learning, Reinforcement learning, Evolutionary computation,Neural networks, Problems, data, and tools; Visualization;

LINEAR REGRESSION :SSE; gradient descent; closed form; normal equations; features, Over fitting and complexity;training, validation, test data, and introduction to Matlab.

CLASSIFICATION PROBLEMS: Decision boundaries; Probability and classification, Bayes optimal decisions,Naive Bayes and Gaussian class-conditional distribution.

E.TEXT BOOKS

T1.Russell, Norvig, Artificial intelligence: A modern approach, 2nd edition. Pearson/Prentice Hall.

F. REFERENCE BOOKS

R1.EthemAlpaydin, Introduction to Machine Learning, Second Edition,

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G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		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
[CO1]	Identify problems that are amenable to solution by AI methods.	3	3		2									3			
[CO2]	Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.	2	2	3	2									2	3		
[CO3]	Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.	2	2	3	3									3	3		
[CO4]	able to design and implement various machine learning algorithms in a range of real-world applications.		2	3	2	3									3		
[CO5]	Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	3	3		2									3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Cyber Security Laws, Standards & IPR

Code: BTE28351

3 Credits | Semester VIII

A. Introduction:

- Cyber Security is to achieve these three elements (Confidentiality, Integrity and Availability) and also knows as CIA Triad. For any organization, it's essential to protect its data, information using security tools.
- Implement Cyber Security Best Practices and Risk Management

B. **Course Outcomes:** At the end of the course, students will be able to

[CO 1] Conduct a cyber security risk assessment
[CO 2]Measure the performance and troubleshoot cyber security systems.
[CO 3]Implement cyber security solutions.
[CO 4] Students able to use cyber security, information assurance, and cyber/computer forensics software/tools.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Internal Assessment (CIA)	Internal Examination	20
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	70
Total		100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

BASIC OF COMPUTER AND CYBER SECURITY: History of Computers, Areas of Application Computers and its components, Application Software and System Software
Introduction to Operating System. Basics of Networks and internet, Types of Network, Definition of Cyber Security, Search Engines, E –mails and WWW; Internetworking Devices, Internet Service provider, IP Address, Working of Email system, Domain Name System, Blogs, Peer to peer sharing, Computer & Cyber Security:(a) Types of Attacks,(b) Network Security(c) Overview of Security threats,(d) Hacking Techniques,(e) Password cracking(f) Insecure Network connections,(g) Malicious code(h) Concept of Fire wall Security

INFORMATION TECHNOLOGY LAW(CYBER LAW): Evolution of the IT Act, Genesis and Necessity. Salient features of the IT Act, 2000, various authorities under IT Act and their powers. ; Penalties & Offences, amendments. Different kinds of cyber law in Indian history.

CYBER SPACE JURISDICTION: (a) Jurisdiction issues under IT Act, 2000.(b) Traditional principals of Jurisdiction(c) Extra-terrestrial Jurisdiction(d) Case Laws on Cyber Space Jurisdiction

CYBER CRIME AND INVESTIGATION PROCEDURES: Cyber Forensic and Computer Crimes and types. Crimes targeting Computers:Definition of Cyber Crime & Computer related Crimes, Classification & Differentiation between traditional crime and cybercrimes. (a) Data Theft (b) Hacking

(c) Spreading Virus & Worms (d) Phishing (e) Cyber Stalking / Bullying (f) Identity Theft & Impersonation (g) Credit card & Online Banking Frauds, Reasons for Cyber Crimes. Cyber Criminal Mode and Manner of Committing Cyber Crime Prevention of Cyber Crimes & Frauds Critical analysis & loop holes of The IT Act,2000Cyber Crimes: Freedom of speech in cyber space & human right issue Investigation of Cyber Crimes ,Investigation of malicious applications, Agencies for investigation in India, their powers and their constitution as per Indian Laws

E. TEXT BOOKS

T1.Cyber Law & Cyber Crimes by Advocat Prashant Mali; Snow White publications, Mumbai
T2.Cyber Law in India by Farooq Ahmad; Pioneer Books
T3.Information Technology Law and Practice by Vakul Sharma; Universal Law Publishing Co. Pvt. Ltd.
T4The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
T5.Guide to Cyber and E – Commerce Laws by P.M. Bukshi and R.K. Suri; Bharat Law House, New Delhi
T6.Guide to Cyber Laws by Rodney D. Ryder; Wadhwa and Company, Nagpur
T7.The Information Technology Act, 2000; Bare Act – Professional Book Publishers, New Delhi

F. REFERENCE BOOKS

R1.Computer Forensics: Principals and Practices by Linda Volonino, Reynaldo Anzaldua and Jana Godwin; Pearson Prentice – Hall 2007
R2. First Responder's Guide to Computer Forensics by Richard Nolan rt al; Carnegi Mellon, 2005.
R3. Digital Evidence and Computer Crime, 2nd Ed. By Eoghan Casey; Academic Press, 2004.
R4.The Regulation of Cyberspace by Andrew Murray, 2006; Rutledge – Cavendish.
R5. .Scene of the Cybercrime: Computer Forensics Handbook by Syngress.
R6.Security and Incident Response by Keith J. Jones, Richard Bejtloich and Curtis W.Rose

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS 03	PS0 4
[CO1]	Conduct a cyber security risk assessment	**3**	**3**		**2**									**3**			
[CO2]	Measure the performance and troubleshoot cyber security systems.	**2**	**2**		**2**									**2**	**1**		
[CO3]	Implement cyber security solutions.		**2**					**3**		**2**				**3**			
[CO4]	Students able to use cyber security, information assurance, and cyber/computer forensics software/tools.					**2**	**3**	**3**									
[CO5]																	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Major Project

Code: BTE28364

8 Credits | Semester VIII

The object of Project Work & Dissertation is to enable the student to extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In-depth study of the topic assigned in the light of the Report;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Extra-Curricular/Co-Curricular Activity

Code: BTE28390

0 Credits | Semester VIII

AICTE Activity Points to be earned by students admitted to Degree program **(For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.