GURU KASHI UNIVERSITY

Bachelor of Technology in Mechanical Engineering

Session: 2023-24

Department of Mechanical Engineering

IQAC

GRADUATE OUTCOME OF THE PROGRAMME

The program focuses to develop an ability to apply appropriate knowledge in Mechanical Engineering to identify, formulate, analyze, and solve complex engineering problems in order to develop sustainable computing solutions in broader economic, societal and environmental contexts.

PROGRAMME LEARNING OUTCOMES

After completing the programme, the learner will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate and analysis complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
5. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
6. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
7. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
8. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Structure

Semester: I						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BME101	Basic Electrical Engineering	Core	3	0	0	3
BME110	Engineering Physics	Core	3	1	0	4
BME111	Engineering Mathematics–I	Core	3	1	0	4
BME104	Engineering Graphics & Drawing	Core	1	0	4	3
BME112	Engineering Physics Lab	Skill Based	0	0	4	2
BME106	Basic Electrical Engineering Lab	Skill Based	0	0	4	2
BME113	Fundamental of Computer and Information Technology	Value added	2	0	0	2
BME114	Constitution of India	Value added	2	0	0	NC
Total			14	2	12	20

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Semester: II						
Course Code	**Course Name**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BME201	Engineering Chemistry	Core	3	0	0	3
BME214	Engineering Mathematics–II	Core	3	1	0	4
BME203	Programming for Problem Solving	Core	3	0	0	3
BME204	Communication Skills	Skill based	3	0	0	3
BME205	Manufacturing Practices	Skill based	1	0	4	3
BME206	Engineering Chemistry Lab	Skill based	0	0	2	1
BME207	Programming for Problem Solving Lab	Skill based	0	0	2	1
BME208	Communication Skills Lab	Skill based	0	0	2	1
Value Added Course(Any one) For otherdisciplines						
BME209	Entrepreneurship Development	VAC	2	0	0	2
BME210	Numerical Aptitude & Reasoning Ability					
BME211	Stress Management					
Total			15	1	10	21

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Semester: III						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BME313	Engineering Physics-II	Core	3	1	0	4
BME314	Engineering Mathematics-III	Core	3	1	0	4
BME315	Environmental Science	Value based	2	0	0	2
BME316	Basic Electronics Engineering	Core	3	1	0	4
BME317	Engineering Mechanics	Core	3	1	0	4
BME318	Applied Thermodynamics	Core	3	1	0	4
BME319	Engineering Physics-II	Skill based	0	0	2	1
BME320	Basic Electronics Engineering Lab	Skill based	0	0	2	1
BME399	xxx	MOOC	-	-	-	2
Total			17	5	4	26

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Semester: IV						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BME411	Heat Transfer & Thermal Machines	Core	3	1	0	4
BME412	Fluid Mechanics & Hydraulic Machines	Core	3	1	0	4
BME413	Mechanics of Deformable Solids	Core	3	1	0	4
BME414	Engineering Materials & Applications	Core	3	1	0	4
BME415	Kinematics & Dynamics of Machines	Core	3	1	0	4
BME416	Mech. Engg. Lab-I(Thermal & Fluid)	Skill based	0	0	4	2
Total			15	5	4	22

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Semester: V						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BME511	Machine Elements & System Design	Core	3	1	0	4
BME512	Mechatronics, Robotics & Control	Core	3	0	0	3
BME504	Manufacturing Processes	Core	3	1	0	4
BME513	Measurements & Metrology	Core	3	0	0	3
BME514	Mechatronics, Robotics & Control Lab	Skill based	0	0	2	1
BME515	Measurements & Metrology Lab	Skill based	0	0	2	1
BME516	Mech. Engg. Lab-II(Design) Lab	Skill based	0	0	4	2
BME517	Project Management	Skill based	3	0	0	3
BME599	Xxx	MOOC	-	-	-	2
Total			15	2	8	23

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Semester: VI						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BME611	Computer Aided Design & Analysis	Core	3	0	0	3
BME612	Manufacturing Automation	Core	3	0	0	3
BME613	Production & Operation Management	Core	3	1	0	4
BME614	Product Innovation & Entrepreneurship	Core	3	1	0	4
BME615	Mech. Engg. Practical-III (Manufacturing)	Skill based	0	0	4	2
BME616	Computer Aided Design & Analysis Lab	Skill based	0	0	2	1
BME617	Manufacturing Automation Lab	Skill based	0	0	2	1
BME618	Operation Research	Skill based	3	0	0	3
BME619	Engineering Project-I(Literature Review)	Skill based	0	0	4	2
Total			15	2	12	23

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Semester: VII						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
XXX	Professional Elective-I	Discipline Elective-I	3	0	0	3
XXX	Professional Elective-II	Discipline Elective -II	3	0	0	3
XXX	XXX	Open Elective-I	3	0	0	3
XXX	XXX	Open Elective-II	3	0	0	3
BME713	Engineering Project-II (Design & Analysis)	Skill based	0	0	10	5
BME714	Seminar	Skill based	0	0	2	1
BME799	xxx	MOOC	-	-	-	2
Total			12	0	12	20
Open Elective Courses for other Departments						
OEC084	Supply Chain Management	Open Elective-I	3	0	0	3
OEC085	Six Sigma	Open Elective-II				

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Semester: VIII						
Course Code Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	Credits
XXX	Professional Elective-III	Discipline Elective -III	3	0	0	3
XXX	XXX	Open Elective-III	3	0	0	3
BME802	Engineering Project-III (Prototype & Testing)	Skill based	0	0	16	8
Total			**6**	**0**	**16**	14
Grand Total			**108**	**17**	**78**	**166**
Open Elective Courses for other Departments						
OEC069	Total Quality Management	Open Elective-III	3	0	0	3

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Professional Elective Courses

Total**3** to be taken, atleast one fromeach group–*Technology* and *Industry Sector*, based on Project topic and individual interest. Illustrative courses are listed here

Technology					
Course	**Course Title**	**L**	**T**	**P**	**Credits**
BME901	Finite Element Analysis	3	0	0	3
BME902	Computational Fluid Dynamics	3	0	0	3
BME903	Power Plant Engineering	3	0	0	3
BME904	Renewable Energy Engineering	3	0	0	3
BME905	Design for Manufacturing & Assembly	3	0	0	3
BME906	Eco-Friendly (Green) Design	3	0	0	3
BME907	Additive Manufacturing	3	0	0	3
BME908	Die, Mold and Tool Engineering	3	0	0	3
IndustrySector					
Course	**Course Title**	**L**	**T**	**P**	**Credits**
BME909	Automobile Engineering	3	0	0	3
BME910	Aerospace Engineering	3	0	0	3
BME911	Agricultural Engineering	3	0	0	3
BME912	Biomedical Engineering	3	0	0	3
BME913	Food Technology	3	0	0	3
BME914	Marine Engineering	3	0	0	3
BME915	Nuclear Engineering	3	0	0	3
BME916	Textile Engineering	3	0	0	3

Open Elective Courses

Student will select any **3** courses (from any department), based on individual interest and project list provided by the dean academic office.

Mandatory Visits/ Workshop/Expert Lectures

1. It is mandatory to arrange one industrial visit every semester for the students of each branch.
2. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.
3. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from domain specific industry.

Evaluation Criteria for Theory Courses

A. **Continuous Assessment: [30 Marks]**

CA-I Surprise Test (Two best out of three) - (10 Marks)

CA-II Assignment(s) (10 Marks)

CA-III Term paper/Quiz/Presentation (5 Marks)

B. **Attendance (5 marks)**

C. **Mid Semester Test: [30 Marks]**

D. **End Semester Exams: [40 Marks]**

Evaluation Criteria for Practical Courses

Performance of each practical-(10 Marks)

Report- (5 Marks)

Practical Viva – **(**5 Marks)

Total - (20 Marks) (Each Practical)

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SEMESTER- I

Course Title: BASIC ELECTRICAL ENGINEERING
Course Code: BME101

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the DC and AC electrical circuit elements with RLC.
2. Analysis of simple circuits with dc excitation. Superposition, The venin and Norton Theorems.
3. Use Single Phase AC Circuits and representation of alternating quantities and determining the power in these circuits.
4. Classify the different types of Electrical machines.

Course Content

UNIT I **15 Hours**

DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II **10 Hours**

AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Transformers

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT III **10 Hours**

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.

UNIT IV **10 Hours**

Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Electrical Installations

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.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Kothari, D. P. and Nagrath, I. J. (2010). Basic Electrical Engineering. Tata McGraw Hill.*
- *Kulshreshtha, D. C. (2009). Basic Electrical Engineering. McGraw Hill.*
- *Bobrow, L. S. (2011). Fundamentals of Electrical Engineering. Oxford University Press.*
- *Hughes, E. (2010). Electrical and Electronics Technology. Pearson*

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COURSE TITLE: ENGINEERING PHYSICS
COURSE CODE: BME110

L	T	P	Credits
3	1	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
2. Use the knowledge regarding calculus along with physical principles to effectively solve problems encountered in everyday life, further study in science, and in the professional world.
3. Design experiments and acquires data in order to explore physical principles, effectively communicate results, and evaluate related scientific studies.
4. Assess the contributions of physics to our evolving understanding of global change and sustainability while placing the development of physics in its historical and cultural context.

Course Content

UNIT I **15 Hours**

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential, Boundary conditions of electric field and electrostatic potential; method of images. Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

UNIT II **15 Hours**

Magneto statics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; vector potential and its solution for given current densities. Properties of magnetic materials: magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials.

Time Varying Field and Maxwell's Equation: Laws of Electromagnetic Induction, Self and Mutual induction, Concept of Displacement Current, Difference between Conduction Current and Displacement Current, Eddy Current, Maxwell's Equations, Derivation of Maxwell's Equations, Propagation of Electromagnetic Waves in Free Space, Solution of propagation of Plane Electromagnetic Wave in free space.

UNIT III **15 Hours**

Semiconductors: Intrinsic and extrinsic semiconductors, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Semiconductor materials of interest for optoelectronic devices.

Modern Physics: Particle properties of wave: Planck's hypothesis, Qualitative discussion of Photoelectric effect and Compton Effect. Wave properties of particle: De Broglie wave as mater waves, Heisenberg's uncertainty principle and its application. Quantum Mechanics: Interpretation of wave function, Schrödinger equation (time dependent and time independent), particle in a box,

UNIT IV **15 Hours**

Wave Optics: Interference due to division of wavefront, Young's double slit expt., Principle of Superposition, Interference from parallel thin films, Newton rings, Michelson interferometer. Diffraction: Fresnel Diffraction, Diffraction at a straight edge, Fraunhoffer diffraction due to N slits, Diffraction grating, dispersive and resolving power of Grating. Polarization**:** production of plane polarized light by different methods, Brewster and Malus Laws. Double refraction, Quarter & half wave plate, Nicol prism, specific rotation, Laurent's half shade polarimeter.

Laser: Introduction, principle of Laser, stimulated and spontaneous emission, Einstein's Coefficients, He-Ne Laser, Ruby Laser, Application of Lasers.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *David J Griffths, Introduction to Electrodynamics. Prentice Hall, 2015.*
- *Saslow, W.,Electricity, magnetism and light. e-book.*
- *Subramaniam N & BrijLal, Optics, S Chand & Co. Pvt. Ltd., New Delhi*
- *R Murugeshan, Kiruthiga, Sivaprasath, Modern Physics, S Chand & Co. Pvt. Ltd., New Delhi.*
- *M.N.Avadhanulu, Engineering Physics, S.Chand& Company Ltd.*
- *Arthur Beisser, Concepts of Modern Physics, McGraw Hill Publications, 1981.*

COURSE TITLE: ENGINEERING MATHEMATICS-I
COURSE CODE: BME111

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. 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.
2. Classify of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. Illustrate the Tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. Use of functions of several variables that is essential in most branches of engineering and tools of matrices and linear algebra in a comprehensive manner.

Course Content

UNIT I **16 Hours**

a. Calculus:

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

b. Advanced Calculus

Differentiation: Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Integration: Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT II **14 Hours**

Trigonometry

Hyperbolic and circular functions, logarithms of complex number resolving real and imaginary parts of a complex quantity, De Moivre's Theorem.

Theory of equations:Relation between roots and coefficients, reciprocal Equations, transformation of equations and diminishing the roots.

UNIT III **15 Hours**

Sequences and series

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT IV **15 Hours**

Algebra

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.*
- *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.*
- *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.*
- *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
- *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.*
- *G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.*
- *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.*
- *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.*
- *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
- *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.*
  1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- *2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.*
- *Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.*
- *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.*
- *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
- *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.*

COURSE TITLE: ENGINEERING GRAPHICS &DRAWING
COURSE CODE: BME104

L	T	P	Credits
1	0	4	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:
1. Understand about engineering drawing applications and its importance in society.
2. Learn about the visual aspects of engineering design.
3. Discuss the engineering graphics standards.
4. Classify the concept of solid modeling techniques.

Course Content

UNIT I **9 Hours**

1. Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.
2. Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes.

UNIT II **12 Hours**

1. Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
2. Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT III **14 Hours**

1. Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
2. Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
3. Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT IV **10 Hours**

1. Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines

(extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerance techniques; dimensioning and scale multi views of dwelling;

2. Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerance; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Gill, P.S.(2001).Engineering Drawing. S.K; Kataria and Sons, Ludhiana.*
- *Bhatt, N.D.(2012). Engineering Drawing. Charotar Book Stall, TulsiSadan, Anand.*
- *French, T.E. and Vierck. C.J.(1993).Graphic Science. McGraw-Hill, New York.*
- *Zozzora, F.(1958). Engineering Drawing. McGraw Hill, NewYork.*
- *(Corresponding set of) CAD Software Theory and User Manuals*

Course Title: ENGINEERING PHYSICS LAB
Course Code: BME112

L	T	P	Credits
0	0	4	2

Total Hours-30

Learning Outcomes On successful completion of this course, the students would be able to:

1. Illustrate the working p-n junction diode.
2. Analyse and solve various engineering problems.
3. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
4. Design new instruments with practical knowledge.

Course Content

List of experiments

1. To study the V-I characteristics of P-N junction.
2. To verify the logic gates.
3. To calculate the acceleration due to gravity "g" using simple pendulum.
4. To find the moment of inertia of flywheel.
5. To measure the diameter of a small spherical/cylindrical body using Vernier calipers/screw gauge.
6. To draw V-I characteristics of Zener diode and determine reverse breakdown voltage.
7. To study the controls and obtain a wave using Cathode Ray Oscilloscope.
8. To find the resolving power of the prism.
9. To determine the angle of the given prism.
10. To determine the refractive index of the material of a prism.
11. To understand the phenomenon Photoelectric effect as a whole.
12. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
13. To determine the Planck's constant from kinetic energy versus frequency graph.
14. To plot a graph connecting photocurrent and applied potential.
15. To determine the stopping potential from the photocurrent versus applied potential graph.

Note : Students will perform any 7-8 experiments from the syllabus.

Course Title: BASIC ELECTRICAL ENGINEERING LAB
Course Code: BME106

L	T	P	Credits
0	0	4	2

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.
2. Understand the Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.
3. Analysis of Single-Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
4. Compare different types of Electrical machines and classify different electrical measuring equipment's and understanding their principles

Course Content

List of Experiments:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Title: Fundamental of Computer and Information Technology
Course Code: BME113

L	T	P	Credits
2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the concept of input and output devices of Computers
2. Study to use the Internet safely, legally, and responsibly.
3. discuss an operating system and its working, and solve common problems related to operating systems
4. Learn basic word processing, Spreadsheet and Presentation Graphics Software skills

Course Content

UNIT I **8 Hours**

Computer Hardware / Software- Definition, History, Generation, Characteristics, Types & Applications, Overview of a computer system:

Hardware/Software-Definition of Hardware**,** Input Unit: Keyboard, Mouse, Scanner etc**,** CPU: Arithmetic Logic Unit (ALU), Control Unit (CU), Memory Unit (MU)**,** Output Unit: Monitor, Printer etc**,** Storage Devices: Primary &Auxulary Memory (Floppy Disk, Hard Disk, Compact Disk, DVD, Flash Disk etc)**,** Others: Network Card, Modem, Sound Card etc.

Software: Definition & types of Software, Programming Language, Liveware, Firmware and Cache Memory

UNIT II **7 Hours**

Setting & Protection of Computer Room and Computer- Concept of **Computer related threats** (virus, worms, Trojan, phishing etc) remedies and protection

File Management basics: Physical structure of disk

UNIT III **7 Hours**

Concept of E-mail / Internet / Extranet, World Wide Web (WWW)- Familiarity with internet browsers (eg.Inernet Explorer, Firefox, Opera, Safari, Google Chrome etc.), Introduction of IP address, suBMEt mask and default gateway, Introduction to Network Media, topology and protocol, Setting up Microsoft Network, Dial-Up Networking

UNIT IV **8 Hours**

Number System: Introduction to binary, octal, decimal and hexadecimal number system Introduction to ASCII and Unicode standards

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Rajaraman, V., & Adabala, N. (2014). Fundamentals of computers. PHI Learning Pvt. Ltd..*
- *Doja, M. N. (2005). Technology. Deep and Deep Publications.*
- *Bangia, R. (2008). Computer Fundamentals and Information Technology. Firewall Media.*

Course Title: Constitution of India
Course Code: BME114

L	T	P	Credits
2	0	0	NC

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Knowledge and legal literacy and thereby to take up competitive examinations
2. Understand state and central policies, fundamental duties, Electoral Process, and special provisions
3. Analyze powers and functions of Municipalities, Panchayats and Co-operative Societies, and
4. Classify the engineering ethics and responsibilities of Engineer and an awareness about basic human rights in India

Course Content

Unit I **5 Hours**

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution.

Preamble to the Indian Constitution Fundamental Rights & its limitations.

Unit II **10 Hours**

Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties.

Union Executives – President, Prime Minister Parliament Supreme Court of India.

State Executives – Governor Chief Minister, State Legislature High Court of State.

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.

Unit III **10 Hours**

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India

Powers and functions of Municipalities, Panchyats and Co – Operative Societies.

Unit IV **5 Hours**

Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.

Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Singh Mahendra, P. (2000). VN Shukla's Constitution of India. Eastern Book Company, Lucknow.*
- *Agrawal, P. K., & Gupta, V. (2023). The Constitution of India Bare Act with Short Notes-Useful for Competitive Examinations: Bestseller Book by Dr. PK Agrawal; Virag Gupta: The Constitution of India Bare Act with Short Notes-Useful for Competitive Examinations. Prabhat Prakashan.*
- *Ghosh, P. K. (1966). Constitution of India (Prabhat Prakashan): How it Has Been Framed. Prabhat Prakashan.*

IQAC

SEMESTER-II

L	T	P	Credits
3	0	0	3

Course Title: ENGINEERING CHEMISTRY
Course Code: BME201

Total Hours-45

Learning Outcomes:

On successful completion of this course, the students would be able to:

1. Demonstrate Schrodinger equation, Particle in a box solution and their applications
2. Conjugated molecules and Nanoparticles,
3. Evaluate band structure of solids and the role of doping on band structures.
4. Distinguish the ranges of Vibrational and rotational spectroscopy of diatomic molecules,
5. Applications, Nuclear magnetic resonance and magnetic resonance imaging
5. Rationalize periodic properties such as ionization potential, electro-negativity, Oxidation states and electro-negativity.
6. List the Thermodynamic functions: energy, entropy and free energy and also Estimations of entropy and free energies.

Course Content

UNIT I **15Hours**

Atomic and molecular structure

Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and Nanoparticles, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations, Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT II **10Hours**

1. Spectroscopic techniques and applications

Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Diffraction and scattering.

***2.* Intermolecular forces and potential energy surfaces**

Ionic, Dipolar and Vander Waals interactions, Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

UNIT III **10Hours**

1. Use of free energy in chemical equilibria

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria, Water chemistry, Corrosion,Use of free energy considerations in metallurgy through Ellingham diagrams.

2. Periodic properties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies,

electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

UNIT IV **10Hours**

1. Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

2. Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Mahan, B. H. (1987). University chemistry.*
- *Sienko, M. J. & Plane, R. A. Chemistry. (1979): Principles and Applications. New York: McGraw-Hill.*
- *Banwell, C. N. (1966). Fundamentals of Molecular Spectroscop. New York, McGraw-Hill.*
- *Tembe, B. L., Kamaluddin& Krishnan, (2008). M. S. Engineering Chemistry (NPTEL Web-book).*

IQAC

Course Title: ENGINEERING MATHEMATICS –II
Course Code: BME214

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate the methods of forming and solving Ordinary differential equations and solve linear differential equations with constant and variable coefficients
2. Explain the concept of differential equation and classifies the differential equations with respect to their order and linearity.
3. Solve first-order ordinary and exact differential equations and converts separable and homogeneous equations to exact differential equations by integrating factors.
4. Apply the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.

Course Content

UNIT-I **14Hours**

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders:

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.

UNIT-II **15 Hours**

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.

UNIT-III **15 Hours**

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's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

UNIT-IV **16 Hours**

Transform Calculus

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.
Fourier transforms.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Reading

- *Thomes, G.B.and Finney, R.L. (2010) Calculus and Analytic Geometry; Ninth Edition; Pearson Education*
- *Kreyszig, E. (1998) Advanced Engineering Mathematics; Eighth Edition, John Wiley and sons.*
- *Grewal, B.S. (1965) Higher Engineering Mathematics; Khanna Publishers, New Delhi.*
- *BabuRam (2009) Advance Engineering Mathematics; First Edition; Pearson Education.*
- *Richard Courant and Fritz John (2012) Introduction to Calculus and Analysis, Volume II , V Springer Publication*
- *Harold M. Edwards (2013) Advanced Calculus: A Differential Forms Approach, Birkhauser.*

IQAC

Course Title: PROGRAMMING FOR PROBLEM SOLVING
Course Code: BME203

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design the algorithms to write programs.
2. Illustrate arrays, pointers and structures to formulate algorithms and programs
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration
4. Implement conditional branching, iteration and recursion.

Course Content

UNIT I **15Hours**

1. Introduction to Programming
2. Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
3. Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.
4. From algorithms to programs; source code, variables (with data types) variables and memory
5. Locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **15Hours**

1. Arithmetic expressions and precedence
2. Conditional Branching and Loops
3. Writing and evaluation of conditionals and consequent branching
4. Iteration and loops
5. Arrays: Arrays (1-D, 2-D), Character arrays and Strings

UNIT III **8Hours**

1. Basic Algorithms
   Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of Equations, notion of order of complexity through example programs (no formal definition required)
2. Function
   Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference.
3. Recursion
   Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT IV **7Hours**

1. Structure

Structures, Defining structures and Array of Structures

2. Pointers
   Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
   File handling (only if time is available, otherwise should be done as part of the lab)

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Byron Gottfried, Schaum's (1995), Outline of Programming with C, McGraw-Hill*
- *E. Balaguruswamy (2005) Programming in ANSI C, Tata McGraw-Hill*

IQAC

Course Title: COMMUNICATION SKILLS
Course Code: BME204

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop vocabulary and improve the accuracy in Grammar.
2. Apply the concepts of accurate English while writing and become equally ease at using good vocabulary and language skills.
3. Develop and Expand writing skills through Controlled and guided activities.
4. Compose articles and compositions in English.

Course Content

UNIT I **16Hours**

Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

UNIT II **14 Hours**

Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

UNIT III **8Hours**

Identifying Common Errors in Writing

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

UNIT IV **7Hours**

1. **Nature and Style of sensible Writing)**

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

2. **Writing Practices):** Comprehension, Précis Writing, Essay Writing

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Swan, Michael. (1995). Practical English. OUP.*
- *Wood, F.T. (2007). Remedial English Grammar.Macmillan.*
- *Zinsser, W. (2001). On Writing Well. Harper Resource Book.*
- *Lyons, L. H.&Heasly, B.(2006). Study Writing. Cambridge University Press.*
- *Kumar, S &Lata, P. (2011). Communication Skills. Oxford University Press.*
- *CIEFL, Hyderabad. Exercises in Spoken English. Parts. I-III. Oxford University Press.*

Course Title: MANUFACTURING PRACTICES
Course Code: BME205

L	T	P	Credits
1	0	4	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:
1. Apply the various manufacturing methods in different fields of engineering.
2. Use the different fabrication techniques
3. Learn about the practices in manufacturing of simple components using different materials.
4. Understand the advanced and latest manufacturing techniques being used in engineering industry

Course Content

UNIT I **8Hours**
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing

UNIT II **6Hours**
1. Fitting operations & power tools
2. Electrical & Electronics
3. Carpentry

UNIT III **6Hours**
1. Plastic moulding, glass cutting
2. Metal casting

UNIT IV **10 Hours**

Welding (arc welding & gas welding), brazing [More hours can be given to Welding for Civil Engineering students as they may have to deal with Steel structures fabrication and erection; 3D Printing is an evolving manufacturing technology and merits some lectures and hands-on training. (1 hour)

Workshop Practice:
1. Machine shop - 10 hours
2. Fitting shop - 8 hours
3. Carpentry - 6 hours
4. Electrical & Electronics - 8 hours
5. Welding shop - 8 hours (Arc welding 4 hours) + gas welding 4 hours))
6. Casting - 8 hours
7. Smithy - 6 hours
8. Plastic moulding& Glass Cutting -6 hours

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Raghuwanshi, B.S.(2009). A Course in Workshop Technology, Vol 1 &II.DhanpatRai &Sons.*
- *Jain, R.K.(2010).Production Technology.Khanna Publishers.*
- *Singh, S.(2003).Manufacturing Practice.S.K. Kataria&Sons.*

IQAC

Course Title: ENGINEERING CHEMISTRY LAB
Course Code: BME206

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Evaluate the estimate rate constants of reactions from concentration of reactants/products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Apply the theoretical concepts for result analysis and interpret data obtained from experimentation.
4. Identify the compound using a combination of qualitative test and analytical methods

Course Content

List of Experiments:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Course Title: PROGRAMMING FOR PROBLEM SOLVING LAB
Course Code: BME207

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Create read and write to and from simple text files.
2. Identify and correct logical errors encountered at run time
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.
4. Represent data in arrays, strings and structures and manipulate them through a program

Course Content
List of Experiments:
Tutorial 1: Problem solving using computers
Lab1: Familiarization with programming Environment

Tutorial 2: Variable types and type conversions
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings, memory structure
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration)
Lab 8 and 9: Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling
Lab 12: File operations

Suggested Readings:

- *Byron Gottfried, Schaum's (1995), Outline of Programming with C, McGraw-Hill*
- *E. Balaguruswamy (2005) Programming in ANSI C, Tata McGraw-Hill.*

.

IQAC

Course Title: COMMUNICATION SKILLS LAB
Course Code: BME208

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Illustrate the importance of pronunciation and apply the same day to day conversation.
2. Apply verbal and non-verbal communication techniques in the Professional Environment.
3. Develop coherence, cohesion and competence in Oral discourse.
4. Evaluate the interview process confidently.

Course Content

Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

IQAC

Course Title: Entrepreneurship Development
Course Code: BME209

L	T	P	Credits
1	0	0	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Assess the commercial viability of new technologies, business opportunities and existir companies
2. Plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market
3. Carry out scientific research in the field of entrepreneurship
4. Improved your interpersonal and collaborative skills

Course Content

UNIT I **10 Hours**

Introduction to Generic Skills: Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.

Managing Self: Knowing Self for Self Development- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc., Managing Self – Physical- Personal grooming, Health, Hygiene, Time Management, Managing Self – Intellectual development -Information Search: Sources of information, Reading: Purpose of reading, different styles of reading, techniques of systematic reading, Note Taking: Importance of note taking, techniques of note taking, Writing: Writing a rough draft, review and final draft. Managing Self – Psychological, Stress, Emotions, Anxiety-concepts and significance, Techniques to manage the above.

UNIT II **5 Hours**

Managing in Team: Team - definition, hierarchy, team dynamics, Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group - conversation and listening skills.

UNIT III **5 Hours**

Task Management: Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management

Problem Solving: Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving, Different approaches for problem solving. Steps followed in problem solving. Exercises/case studies on problem solving.

UNIT IV **10 Hours**

Entrepreneurship: Introduction , Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level. Market Survey and Opportunity Identification (Business Planning)- How to start a small scale industry, Procedures for registration of small-scale industry,

List of items reserved for exclusive manufacture in small-scale industry, Assessment of demand and supply in potential areas of growth, Understanding business opportunity, Considerations in product selection, Data collection for setting up small ventures.

Project Report Preparation- Preliminary Project Report, Techno-Economic Feasibility Report, Exercises regarding "Project Report Writing" for small projects.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Khanka, S. S. (2006). *Entrepreneurial development*. S. Chand Publishing.
- Desai, V. (2009). Dynamics of entrepreneurial development and management (pp. 119-134). Himalaya Publishing House.
- Kennedy, A. (2015). *Business development for dummies*. John Wiley & Sons.

IQAC

Course Title: NUMERICAL APTITUDE & REASONING ABILITY
Course Code: BME210

L	T	P	Cr.
1	0	0	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the basic concepts of quantitative ability and logical reasoning Skills
2. Learn the basic concepts of Acquire satisfactory competency in use of reasoning
3. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning
4. Create the ability to appear in exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Course Content

UNIT I **4 Hours**

1. Quantitative Ability (Basic Mathematics)
1.1. Number Systems
1.2. LCM and HCF
1.3. Decimal Fractions
1.4. Simplification
1.5. Square Roots and Cube Roots
1.6. Average
1.7. Problems on Ages
1.8. Surds & Indices
1.9. Percentages
1.10 Problems on Numbers

UNIT II **4 Hours**

2. Quantitative Ability (Applied & Engineering Mathematics)
2.1. Logarithm
2.2. Permutation and Combinations
2.3 Probability
2.4 Profit and Loss
2.5 Simple and Compound Interest
2.6. Time, Speed and Distance
2.7. Time & Work
2.8. Ratio and Proportion
2.9. Area
2.10 Mixtures and Allegation

UNIT III **4Hours**

3. Data Interpretation
3.1. Data Interpretation
3.2. Tables
3.3. Column Graphs
3.4. Bar Graphs
3.5. Line Charts
3.6. Pie Chart
3.7. Venn Diagrams

UNIT IV **3Hours**

4. Logical Reasoning (Deductive Reasoning)
4.1. Analogy
4.2. Blood Relation
4.3 Directional Sense
4.4. Number and Letter Series
4.5. Coding – Decoding
4.6. Calendars
4.7. Clocks
4.8. Venn Diagrams
4.9. Seating Arrangement
4.10. Syllogism
4.11. Mathematical Operations

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal, 2018.*
- *Analytical and Logical reasoning By Sijwali B S*
- *Quantitative aptitude for Competitive examination By R S Agarwal*
- *Analytical and Logical reasoning for CAT and other management entrance test By Sijwali B S*
- *Quantitative Aptitude by Competitive Examinations by AbhijitGuha 4th edition, 2016.*

IQAC

Course Title: STRESS MANAGEMENT
Course Code: BME211

L	T	P	Cr.
1	0	0	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify the nature and causes of stress in organizations
2. Knowledge of stress prevention mechanism
3. Classify the strategies that help cope with stress
4. Apply stress management principles in order to achieve high levels of performance and adopt effective strategies, plans and techniques to deal with stress

Course Content

UNIT I **3Hours**

1. Understanding Stress
1.1 Stress – concept, features, types of stress
1.2 Relation between Stressors and Stress
1.3 Potential Sources of Stress – Environmental, Organizational and Individual
1.4 Consequences of Stress – Physiological, Psychological and Behavioural Symptoms
1.5 Stress at work place – Meaning, Reasons
1.6 Impact of Stress on Performance
1.7 Work Stress Model
1.8 Burnout – Concept
1.9 Stress v/s Burnout

UNIT II **4 Hours**

2. Managing Stress – I
2.1 Pre-requisites of Stress-free Life
2.2 Anxiety - Meaning, Mechanisms to cope up with anxiety
2.3 Relaxation - Concept and Techniques
2.4 Time Management - Meaning, Importance of Time Management
2.5 Approaches to Time Management
2.6 Stress Management - Concept, Benefits
2.7 Managing Stress at Individual level
2.8 Role of Organization in Managing Stress/ Stress Management Techniques
2.9 Approaches to Manage Stress - Action oriented, Emotion oriented, Acceptance oriented.

UNIT III **4 Hours**

3. Managing Stress – II
3.1 Models of Stress Management - Transactional Model, Health Realization/ Innate Health Model
3.2 General Adaption Syndrome (GAS) - Concept, Stages
3.3 Measurement of Stress Reaction - The Physiological Response,
3.4 The Cognitive Response, TheBehavioural Response.
3.5 Stress prevention mechanism - Stress management through mind control and purification theory and practice of yoga education.
3.6 Stress management interventions: primary, secondary, tertiary.
3.7 Meditation – Meaning, Importance

UNIT IV **4 Hours**

4. Stress Management Leading to Success
4.1 Eustress – Concept, Factors affecting Eustress
4.2 Stress Management Therapy - Concept, Benefits
4.3 Stress Counselling - Concept
4.4 Value education for stress management
4.5 Stress and New Technology
4.6 Stress Audit Process
4.7 Assessment of Stress - Tools and Methods
4.8 Future of Stress Management

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Heena T. Bhagtani. (2018). Stress Management. Himalaya Publishing House.*
- *Dutta, P,K, (2010) Stress Management. Himalaya Publishing House.*
- *Roy,S (2012). Managing Stress. Sterling Publication.*

IQAC

Semester-III

Course Title: **ENGINEERING PHYSICS-II**
Course Code: **BME313**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop a solid foundation in physics principles, including mechanics, thermodynamics, and electromagnetism.
2. Understand the behaviour of light, interference, diffraction, and basic wave phenomena.
3. Gain insight into quantum theory, wave-particle duality, and fundamental atomic and molecular physics.
4. Explore relativity, nuclear physics, and particle physics concepts shaping the modern understanding of the universe.
5. Apply physics concepts to solve engineering problems, making informed design and analysis decisions.

CourseContents

Unit I **15 Hours**

Simpleharmonicmotion,dampedandforcedsimpleharmonicoscillator

Mechanicalandelectricalsimpleharmonicoscillators,complexnumbernotationandphasorrepresentation of simple harmonic motion, damped harmonic oscillator – heavy, critical and lightdamping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical andelectrical oscillators, electrical and mechanical impedance, steady state motion of forced dampedharmonicoscillator, powerabsorbed byoscillator.

Unit II **15 Hours**

Non-dispersivetransverseandlongitudinalwavesinonedimensionandintroductionto dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection andtransmissionofwavesataboundary,impedancematching,standingwavesandtheirEigenfrequencies,longitudinalwavesandthewaveequationforthem,acousticswavesandspeedofsound,standing sound waves. Waves with dispersion, water waves, superposition of waves and Fouriermethod,wavegroupsand group velocity.

Unit III **13 Hours**

Thepropagationoflightandgeometricoptics

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws ofreflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance andtransmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lensesandoptical instruments basedon

them, transferformulaand thematrixmethod.

Unit IV **17 Hours**

Waveoptics

Huygens' principle, superposition of waves and interference of light by wave front splitting andamplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer,Mach-Zehnderinterferometer.

Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit ofresolutionandits applicationto vision;Diffraction gratingsandtheirresolvingpower.

Lasers

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light bypopulation inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby,Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionalityandbrightness,laserspeckles, applicationsoflasers inscience,engineeringandmedicine.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *AICTE'sPrescribedTextbook:Physics(Oscillations,Waves&Optics)withLabManualI SBN:978-93-91505-13-4*
- *Bhattacharya&Nag,EngineeringPhysics, 2021.*
- *IanG.Main,Oscillationsandwavesinphysics, 1932.*
- *H.J.Pain,Thephysicsofvibrationsandwaves, 1968.*
- *E.Hecht,Optics, 2016.*
- *A.Ghatak,Optics, 1977.*
- *O.Svelto,PrinciplesofLasers, 1976.*

Course Title: **ENGINEERING MATHEMATICS-III**
Course Code: **BME314**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Ability to solve various types of partial differential equations using specialized techniques.
2. Analyse random variables, calculate moments, and perform hypothesis tests.
3. Apply differential equations in different coordinate systems for real-world problem-solving.
4. Understand the Proficiency in bivariate distributions analysis and curve fitting using least squares method.
5. Understand and apply probability theory, conditional probability, and independence of events.

CourseContents

UNIT I **13 Hours**

DefinitionofPartialDifferentialEquations,Firstorderpartialdifferentialequations,solutionsoffirstorderlinearPDEs;Solutiontohomogenousandnon-homogenouslinearpartialdifferentialequationsof second order by complimentary function and particular integral method. Second-order linearequationsandtheirclassification,Initialandboundaryconditions,D'Alembert'ssolutionofthewaveequation; Duhamel's principle for one dimensional wave equation.

UNIT II **17 Hours**

Heat diffusion and vibrationproblems,Separationofvariablesmethodtosimpleproblemsin Cartesiancoordinates.TheLaplacianin plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendrefunctions.Onedimensionaldiffusion equation andits solution byseparation ofvariables.Probability spaces, conditional probability, independence; Discrete random variables, Independentrandom variables, the multinomial distribution, Poisson approximation to the binomial distribution,infinitesequencesofBernoullitrials,sumsofindependentrandomvariables;

UNIT III **15 Hours**

ExpectationofDiscreteRandom Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.Continuous random variables and their properties, distribution functions and densities, normal,exponential and gamma densities. Bivariate distributions and their properties, distribution of sumsandquotients, conditional densities, Bayes'rule.Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probabilitydistributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these threedistributions,

UNIT IV **15 Hours**

Correlation and regression – Rank correlation. Curve fitting by the method of leastsquares-fittingofstraightlines,seconddegreeparabolasandmoregeneralcurves.Testofsignificance:Largesampletestforsingleproportion,differenceofproportions,Testsforsinglemean,difference of means, and difference of standard deviations. Test for ratio of variances - Chi- squaretestforgoodness offit and independenceofattributes

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *AICTE Prescribed Textbook: Mathematics – II (Probability and Statistics), ISBN: 978-93-91505-41-7*
- *ReenaGarg,EngineeringMathematics,KhannaBookPublishingCompany,2022.*
- *ReenaGarg,AdvancedEngineeringMathematics,KhannaBookPublishingCompany,2021.*
- *ErwinKreyszig, AdvancedEngineeringMathematics,9thEdition,John Wiley&Sons,2006.*
- *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2010.*

IQAC

Course Title: ENVIRONMENTAL SCIENCE
Course Code: BME315

L	T	P	Credits
2	0	0	NC

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Measure environmental variables and interpret results
2. Evaluate local, regional and global environmental topics related to resource usage and management
3. Propose solutions to environmental problems related to resource usage and management
4. Interpret the results of scientific studies of environmental problems
5. Describe threats to global biodiversity, their implications and potential solutions

Course Content

UNIT I **6Hours**

Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

UNIT II **10 Hours**

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution, Pollution case studies.

UNIT III **8 Hours**

Disaster Management: Floods, earthquake, cyclone and landslides.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.

Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

UNIT IV **6Hours**

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Program. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Agarwal, K. C.(1987). Environment Biology. Nidi Publ. Ltd.Bikaner.*
- *Jadhav, H, &Bhosale, V.M.(1995).Environment Protection and Laws. Himalaya Pub House,Delhi*
- *Rao, M. N. &Datta, A.K.(2008).Waste Water Treatment. Oxford & IBH Publ. Co. Pvt.Ltd*

IQAC

Course Title: **BASICELECTRONICENGINEERING**
Course Code: **BME316**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate electronics component and equipments like C.R.O., Function Generator and power supplies.
2. Analyze the V-I characteristics of PN-Junction diode and determine static resistance and dynamic resistance.
3. Interpret the zener diode and study the characteristics of zener diode.
4. Design and plot the input and output characteristics of common emitter transistor and calculate its input and output resistance.

Course Content

UNIT-I **15 Hours**

Diodes and its Applications: Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications.

UNIT-II **15 Hours**

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;

UNIT-III **15 Hours**

Transistor Amplifiers and Oscillators: Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;

UNIT-IV **15 Hours**

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground;

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *David. A. Bell. (2003). Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.*
- *L. Floyd and R. P. Jain (2009). Digital Fundamentals. Pearson Education.*
- *Paul B. Zbar, A.P. Malvino and M.A. Miller. (2009). Basic Electronics – A Text-Lab. Manual, TMH.*

IQAC

Course Title: **ENGINEERINGMECHANICS**
Course Code: **BME317**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand vector representation of forces and moments in static equilibrium.
2. Learn to analyze rigid bodies under various force systems in static equilibrium.
3. Grasp the concepts of trusses, frames, and machines, and analyze their stability.
4. Explore friction forces and their effects on bodies in translational and rotational motion.
5. Understand particle motion, kinematics, and basic principles of dynamics for engineering systems.

CourseContents

UNIT I **15 Hours**

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton'slaws and its completeness in describing particle motion; Form invariance of Newton's Second Law;Solving Newton's equations of motion in polar coordinates; Problems including constraints andfriction;Extension to cylindrical andspherical coordinates.

UNIT II **14 Hours**

Potentialenergyfunction;F=-GradV,equipotentialsurfacesandmeaningofgradient;Conservativeandnon-conservativeforces,curlofaforcefield;Centralforces;ConservationofAngularMomentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits;Keplerproblem; Application: Satellitemanoeuvres;Non-inertialframesofreference;Rotatingcoordinatesystem:Five-termaccelerationformula.CentripetalandCoriolisaccelerations;Applications:Weathersystems,Foucaultpendulum;

UNIT III **13 Hours**

Harmonic oscillator;Dampedharmonicmotion–over-damped,critically dampedandlightly-dampedoscillators; Forced oscillations and resonance.Definitionandmotionofarigidbodyintheplane;Rotationintheplane;Kinematicsinacoordinatesystem rotating and translating in the plane; Angular momentum about a point of a rigid body inplanar motion; Euler's laws of motion, their independence from Newton's laws, and their necessityindescribing rigid bodymotion;

UNIT IV **13 Hours**

Introduction to three-dimensional rigid body motion — only need to highlight the distinction fromtwo-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b)Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in acoplanar manner: e.g. Rod executing conical motion with center of mass fixed — only need to showthat this motion looks two-dimensional but is three-dimensional, and two-dimensional formulationfails.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *AICTE'sPrescribedTextbook:Physics(IntroductiontoMechanics)withLabManualISBN:978-93-91505-059*
- *EngineeringPhysics, Bhattacharya&Nag, 2021.*
- *EngineeringMechanics,DSBedi&MPPoonia, 2018.*
- *EngineeringMechanics,2nd edition—MKHarbola, 2018.*
- *IntroductiontoMechanics—MKVerma, 2008.*
- *An IntroductiontoMechanics—DKleppner&RKolenkow, 1973.*
- *PrinciplesofMechanics—JLSynge & BAGriffiths, 1959.*
- *Mechanics—JPDenHartog, 1961.*
- *EngineeringMechanics- Dynamics,7thed.-JLMeriam, 2012.*
- *MechanicalVibrations—JPDenHartog, 1936.*
- *TheoryofVibrationswith Applications —WTThomson, 1966.*

Course Title: **APPLIEDTHERMODYNAMICS**
Course Code: **BME318**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand of various practical power cycles and heat pump cycles.
2. Analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors
3. Understand phenomena occurring in high speed compressible flows
4. Analyze and interpret compressor and steamturbines.

CourseContents

UNIT I **13 Hours**

Introductiontosolid,liquidandgaseousfuels–Stoichiometry,exhaustgasanalysis-Firstlawanalysisof combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature-Chemicalequilibriumand equilibriumcomposition calculationsusingfreeenergy.

UNIT II **14 Hours**

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-criticalandultra-super-criticalRankinecycle-Gaspowercycles,AirstandardOtto,DieselandDualcycles-AirstandardBraytoncycle,effectofreheat,regenerationandintercooling-Combinedgasandvaporpowercycles-Vaporcompressionrefrigerationcycles,refrigerantsandtheirproperties.

UNIT III **16 Hours**

Properties of dry and wet air, use of pschyrometric chart, processes involving heating/cooling andhumidification/dehumidification,dewpoint.Basicsofcompressibleflow.Stagnationproperties,Isentropicflowofaperfectgasthroughanozzle,choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropicflowandnormalshockflow-Flowofsteamandrefrigerantthroughnozzle,supersaturation-compressibleflowin diffusers, efficiencyofnozzleand diffuser.

UNIT IV **14 Hours**

Reciprocatingcompressors,stagingofreciprocatingcompressors,optimalstagepressureratio,effectofintercooling, minimum workformultistagereciprocatingcompressors.Analysisofsteamturbines,velocityand pressure compoundingofsteamturbines

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals ofThermodynamics,John Wileyand Sons.*
- *Jones,J.B.andDuggan, R.E.,1996,EngineeringThermodynamics,Prentice-HallofIndia*
- *Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, JohnWileyand Sons.*
- *Nag,P.K,1995,EngineeringThermodynamics,TataMcGraw-HillPublishingCo. Ltd*

IQAC

Course Title: **ENGINEERING PHYSICS-II LAB**
Course Code: **BME319**

L	T	P	Cr.
0	0	2	1

Total Hours-15

Learning Outcomes After completion of this course, the learner will be able to:

1. Illustrate the working laser pointer.
2. Analyse and solve various engineering problems.
3. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
4. Design new instruments with practical knowledge.

CourseContents

Suggestedlistofexperimentsfromthefollowing:

Diffractionandinterferenceexperiments(fromordinarylightorlaserpointers);measurementofspeed oflighton atabletopusingmodulation; minimumdeviation fromaprism.

IQAC

Course Title: **BASIC ELECTRONICS ENGINEERING LAB**
Course Code: **BME320**

L	T	P	Cr.
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.
2. Understand the Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.
3. Analysis of Single-Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
4. Compare different types of Electrical machines and classify different electrical measuring equipment's and understanding their principles

CourseContents

List of Experiments

1. Verification of ohms and Kirchhoff's Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

Semester:IV

Course Title: HEATTRANSFER&THERMALMACHINES
Course Code: BME411

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Formulateandanalyzea heat transferproblem involvinganyofthethreemodesofheattransfer
2. Examineexactsolutionsforthetemperaturevariationusinganalyticalmethodswherepossibleoremployapproximatemethods orempirical correlationsto evaluatetherate ofheat transfer.
3. Designheatexchangersandestimatetheinsulationneededtoreduceheatlosseswherenecessary.

CourseContents

UNIT I **14 Hours**

Three modes of heat transfer; Examples of equipment (like air conditioner and air cooler) involvingheattransfer; Derivation ofheat balanceequation.Steady 1D solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry;Conceptofconductionandfilmresistances;Criticalinsulationthickness;Lumpedsystemapproximation and Biot number; Heat transfer through pin fins; 2D conduction solutions for steadyand unsteadyheat transfer.

UNIT II **18 Hours**Basicequations;Boundarylayers;Forcedconvection;Externalandinternalflows;Naturalconvective heat transfer; Dimensionless parameters for forced and free convection heat transfer;Correlations for forced and free convection; Approximate solutions to laminar boundary layerequations for internal and external flow; Estimating heat transfer rates in laminar and turbulent flowsituationsusingappropriatecorrelations for freeand forcedconvection.Interaction of radiation with materials; Definitions of radiative properties; Stefan Boltzmann's law;Blackandgreybodyradiation;Calculationofradiationheattransferbetweensurfacesusingradiativeproperties; View factors and the radiosity method; Examples for two-body enclosures; Radiationshield.

UNIT III **15 Hours**Function, classification and configuration of heat exchangers; Evaluation of mean temperaturedifference;Heatexchangereffectiveness;Analysis,designandselectionof heatexchangers.Poolboiling;Flowboiling;Filmanddrop wisecondensation

UNIT IV **13 Hours**Analogy between heat and mass transfer; Mass diffusion; Fick's Law; Steady and transient massdiffusion;Simultaneousheat and mass transfer.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *A.Bejan, "HeatTransfer,"JohnWiley,1993.*
- *J.P.HolmanandS.Bhattacharyya,"HeatTransfer,"McGrawHill,2017.*
- *F.P. Incropera, andD.P.Dewitt,"FundamentalsofHeatandMassTransfer,"JohnWiley,2019.*
- *MassoudKaviany,"PrinciplesofHeatTransfer,"JohnWiley,2002.*
- *YunusACengel,"HeatTransfer:APracticalApproach,"McGrawHill,2002.*

IQAC

Course Title: **FLUID MECHANICS & HYDRAULICMACHINES**

Course Code: **BME412**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the concept of Comprehend the fundamental properties and behaviour of fluids, including viscosity, pressure, and buoyancy.
2. Analysis the Master fluid flow principles, equations of motion, and Bernoulli's theorem for analysing fluid behaviour in various scenarios.
3. Learn techniques to measure fluid flow rates and pressures, and explore methods for controlling fluid flows.
4. Apply fluid mechanics principles to solve real-world engineering problems, from pipe design to energy conversion in hydraulic systems.

CourseContents

UNIT I **15 Hours**

Definitionoffluid;Newton'slawofviscosity;Unitsanddimensions;Physicalproperties of fluids; Control volume; Continuity equation and momentum equation; Incompressibleflow;Bernoulli's equation and its applications.Dimensionallyhomogeneousequations;BuckinghamPiTheorem;Calculation of dimensionless parameters. Similitude and complete similarity; Model scales; Basicboundarylayertheoryand analysis.

UNIT II **15 Hours**

Different approaches; Reynolds transport theorem; Flow visualization; Types offlow;Strainrate,streamline,streakline,pathlinesandstreamtubes;Continuityequationin Cartesiancoordinatesin3Dforms;Velocityandaccelerationoffluidparticles;Velocitypotentialfunctionandstreamfunction. Momentum equation;Nervier Stoke equation; Developmentof Euler'sequation; Bernoulli's equation and application; Steady and unsteady flow through orifice; Orificeplacedinpipe; Venturimeter;Flowovertriangularandrectangularnotches;Pitot tube.(4)

UNIT III **15 Hours**

Viscous/Laminar flow – Plane Poiseuille flow and Coutte flow;Laminar flow through circular pipes; Loss of head and power absorbed in viscous flow; *Turbulentflow*– Reynoldsexperiment;Frictionallossesinpipeflow;Shearstressinturbulentflow;Major andminor losses (Darcy's and Chezy's equation); Flow through siphon pipes; Branching pipes andequivalentpipe.

UNIT IV **15 Hours**

Euler'sequation;TheoryofRotodynamicmachines;Variousefficiencies;Velocity components at entry and exit of the rotor; Velocity triangles; Centrifugal pumps – workingprinciple, work done by the impeller and performance curves; Cavitation in pumps; Reciprocatingpump– workingprinciple. Classification of water turbines; Heads and efficiencies; Velocity triangles;Axial, radial and mixed flow turbines;

Pelton wheel, Francis turbine and Kaplan turbines – workinganddesign principles.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *S.S.Rattan,FluidMechanics&HydraulicMachines,Khanna BookPublishing,2019.*
- *P.J.Pritchard,A.T.McDonaldandR.W.Fox,"IntroductiontoFluidMechanics,"WileyIndia,2012.*
- *F.M.White,"FluidMechanics,"TataMcGrawHill,2011.*
- *S.K.Som,G.BiswasandS.Chakraborty,"IntroductiontoFluidMechanicsandFluidMachines,TataMcGrawHill, 2017.*
- *R.K.Bansal,"ATextbookofFluidMechanicsandHydraulicMachines," LaxmiPublication,2005.*
- *Mechanicsof Fluids,Shames,McGrawHillBook Co.,NewDelhi,1988*

IQAC

Course Title: **MECHANICSOF DEFORMABLESOLIDS**
Course Code: **BME413**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Recognizevarioustypesloadsappliedonmachinecomponentsofsimplegeometryan dunderstandthenatureofinternalstresses that willdevelop withinthecomponents
2. Evaluatethestrainsanddeformationthatwillresultduetotheelasticstressesdevelop edwithinthematerials forsimpletypes ofloading
3. Analysisanddesignbeams,shaftsandhollowcylinders.

CourseContents

UNIT I **15 Hours**

Deformation of bars: Hooke's law, stress, strain, and elongation; Tensile, compressive and shearstresses in 2D solids; Elastic constants and their relations; Volumetric, linear and shear strains;Principalstresses and strain;Principal planes; Mohr's circle.Transverse loading on beams, point and distributed loads; Shear force and bend moment diagrams;

UNIT II **13 Hours**

Types of beam supports – simply supported, over-hanging, cantilevers, fixed and guided beams;Staticdeterminacyandindeterminacy; Theoryofbendingofbeams,purebendingstressdistributionandneutralplane,second momentofarea;Differentcross-sectionsofbeams;Shearstressdistribution.

UNIT III **17 Hours**

Deflection of a beam using the double integration method; Computation of slopes and deflection inbeams;Myosotis methodforcomputingdeflectionsand slopes. CriticalloadsusingEuler'stheory; Differentboundaryconditions;Eccentriccolumns.Torsionstressesanddeformationofcirc ularandhollowshafts;Polarmomentofarea,steppedshafts;Deflectionofshaftsfixed atboth ends;Stresses and deflectionofhelicalsprings.

UNIT IV **15 Hours**

Principle of virtual work; Minimum potential energy theorem; Castigliano's theorems; Maxwellreciprocitytheorem.Axial and hoop stresses in cylinders subjected to internal pressure; Deformation of thin and thickcylinders;Deformationinsphericalshellssubjectedtointernalpressure;Combine dthermo-mechanicalstress; Examples and casestudies(boilers).

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *E.P.Popov,"EngineeringMechanicsofSolids,"Pearson,2015.*
- *TimoshenkoandGere,"MechanicsofMaterials",CBSPublishers,2011.*
- *R.Subramanian,"StrengthofMaterials,"Oxford UniversityPress,2007.*
- *D.S.Bedi,"Strengthof Materials",KhannaBookPublishing.2022.*
- *D.S.Bedi,"EngineeringMechanics",KhannaBookPublishing.2021.*
- *F.P.Been,R.JohnsonJrandJ.J.Dewole,"MechanicsofMaterials,"TataMcGrawHill,Delhi2005.*
- *L.SSrinath,Advanced MechanicsofSolids,McGrawHill,2017.*

IQAC

Course Title:	**ENGINEERINGMATERIALSANDAPPLICATIONS**	**L**	**T**	**P**	**Cr.**
Course Code:	**BME414**	3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Selecttherangeofengineeringmaterials,theirmechanicalpropertiesandapplications
2. Understand thevariousmethodstomeasurethemechanicalpropertiesofmaterials
3. Learnhowtoimprovethepropertiesofferrousalloysthroughvariousheat treatments

CourseContents

UNIT I **15 Hours**

Metals,plastics,ceramicsandcomposites;Relevantproperties(physical,mechanical,thermal,electrical,chemical),cost;Rangeofapplications;Materialdesignationandstandards;Ashbydiagrams;Selection criteriaand process. Tensile,compression,torsion,fatigue,fractureandweartests;Young'smodulus;Relationsbetweentrue and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength;ductility,resilience,toughnessandelasticrecovery;Hardnessmeasurementtheirrelationtostrength;SNcurve,enduranceandfatiguelimits;Introductionto non-destructivetesting(NDT).

UNIT II **15 Hours**

Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze&cupro-nickel;Aluminium&Al-Cu-Mgalloys;Nickelbasedsuperalloys&Titaniumalloys;Phasediagrams and interpretation of microstructure; Iron Iron-carbide phase diagram and cooling (TTT)diagrams.HeattreatmentofSteel;Annealing,tempering,normalizing,spheroidising,austempering,martempering,casehardening,carburizing,nitriding,cyaniding,carbo-nitriding,flameand induction hardening, vacuum and plasmahardening

UNIT III **15 Hours**

Polymers – Classification and applications; Polymerizationtechniques;*Ceramics*–Oxideceramics,ceramicinsulators,bio-ceramicsandGlasses;*Composites*–Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Otheradvanced materials – biomaterials, optical materials, high temperature materials, energy materials,andnanomaterials.

UNIT IV **15 Hours**

Conducting and resisting materials – types, properties andapplications;*Semiconductingmaterials*–propertiesandapplications;*Magneticmaterials*–Softandhardmagneticmaterialsandapplications;*Superconductorsanddielectricmaterials*–propertiesandapplications;Smartmaterials;Sensorsandactuators;Piezoelectric,magnetostrictiveandelectrostrictivematerials.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *W.D.Callister,"MaterialsScience&Engineering,"WileyIndia,2014.*
- *K.G.BudinskiandM.K. Budinski,"EngineeringMaterials",PHIIndia,2002.*
- *V.Raghavan, "Material ScienceandEngineering',PHIIndia,2015.*
- *U.C.Jindal,"EngineeringMaterialsandMetallurgy",Pearson,2011.*

IQAC

Course Title: **KINEMATICSANDDYNAMICSOFMACHINES**
Course Code: **BME415**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop proficiency in analyzing motion patterns and geometrical relationships in machine mechanisms.
2. Understand the concepts of velocity and acceleration analysis, determining dynamic behavior of machine components.
3. Learn techniques to analyze forces and torques in moving mechanisms, aiding in design and optimization.
4. Apply kinematics and dynamics principles to assess the performance, efficiency, and safety of machine systems.

CourseContents

UNIT I **15 Hours**

Definition and types of joints; Lower and higher pairs; Classification of mechanisms based onfunctionandconstraints;Commonmechanismssuchasslidercrankand4-barmechanismsandtheirinversions; Quick return mechanism, Straight line generators, rocker mechanisms, universal joints,steeringmechanisms, etc.

UNIT II **15 Hours**

DegreeoffreedomandGrübler'sformula;Grashof'sruleandrotatability limits;Mechanicaladvantage;Transmission angle;Limit positions.Graphical synthesis of dyads and crank-rocker for two- and three-position synthesis for path andmotiongeneration.Displacement, velocity, and acceleration analysis; Velocity analysis using instantaneous centers;Position,velocityandaccelerationanalysisusingloopclosureequations;Coincidentpoints;Corioliscomponentofacceleration.

UNIT III **15 Hours**

Two & three force members; Force & moment equilibrium; Inertial forces; Equations of motion forforce-bar and slider-crank mechanisms.Classification and terminology; Displacement, velocity, acceleration and jerk diagrams; Uniformvelocity,parabolic,simpleharmonicandcycloidalmotions;Derivativesoffollowermotions;Circularandtangentcams;Pressureangleandundercutting;Graphicalandanalyticaldisccamprofilesynthesisforrollerandflat facefollowers.

UNIT IV **15 Hours**

Involute and cycloidal profiles; gear parameters; Fundamental law of gearing and conjugate action;Spur gear contact ratio and interference; Helical, bevel, worm, rack & pinion gears; Epicyclic andregular geartrain kinematics;Force analysis ofspur,helical, beveland wormgearing.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *ThomasBevan,"TheoryofMachines," CBSPublishers&Distributors,2005.*
- *W.L.Cleghorn,"Mechanisms ofMachines,"Oxford UniversityPress,2005.*
- *R. L.Norton,"KinematicsandDynamicsofMachinery,"TataMcGrawHill,2009.*

IQAC

Course Title: **MECHANICALENGG.LAB-1(THERMAL&FLUID)**

Course Code: **BME416**

L	T	P	Cr.
0	0	4	2

Total Hours-30

Learning Outcomes:

After completion of this course, the learner will be able tomeasurevariouspropertiesoffluidsandcharacterizetheperformanceoffluid/thermal machinery.

CourseContents

1. MeasurementofCoefficientofDischargeofgiven OrificeandVenturimeters
2. Determinationofthedensity&viscosityofan oil and friction factorofoil flowin apipe
3. Determinationoftheperformancecharacteristicsofacentrifugalpump
4. DeterminationoftheperformancecharacteristicsofPeltonWheel
5. DeterminationoftheperformancecharacteristicsofaFrancisTurbine
6. DeterminationoftheperformancecharacteristicsofaKaplan Turbine
7. Determinationofthethermal conductivityandspecificheatof givenobjects
8. Determinationofthe calorificvalueof a givenfuelanditsflash &firepoints
9. Determinationofthep-Vdiagramandtheperformanceof a4-strokediesel engine
10. Determinationofthe convectiveheattransfercoefficientforflowoveraheated plate
11. Determinationofthe emissivityofagivensample
12. Determinationoftheperformancecharacteristicsofavapourcompressionsystem

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Semester:V

Course Title: **MACHINEELEMENT&SYSTEMDESIGN**
Course Code: **BME511**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop the ability to choose appropriate materials and components for designing reliable and efficient mechanical systems.
2. Understand design factors such as stress analysis, fatigue, wear, and optimization for safe and durable machine elements.
3. Learn various methods of joining components, including welding, fasteners, and adhesives, while considering their structural integrity.
4. Familiarize yourself with industry standards and codes to ensure compliance and safety in machine element design.

CourseContents

UNIT I **15 Hours**

Anatomyofmachines;Functionaldissectionofmotorcycle,washingmachine,sewingmachine,etc.into machine elements including gears, rack and pinions, cams, chains, belts, pulleys, flywheels,bearings,shafts,keys,brakes,etc.;Designconsiderations–Limits,fitsandstandardization;Frictionandlubrication.Forceanalysisofmachineelementsandmachinesystems;Applicationtopowerscrewsandcouplings,clutches, andbrakes.

UNIT II **13 Hours**

Static failure theories including normal stress theory, shear stress theory, distortion energy theory;von Mises stress; Factor of safety; Stress concentration factors; Fatigue failure theories: mean andalternatingstresses,yield,ultimate,andendurancestrength;Goodman,Gerber,andSoderberglines.

UNIT III **17 Hours**

Springs – Helical compression, tension, torsional and leaf springs; *Fasteners* – threaded fasteners,bolted joints, preloaded bolts, rivets and welded joints; *Shafts* – shafts under static and fatigueloadings;Keys;Slidingandrollingcontactbearings;*Transmissionelements*–transmissionratioandefficiencyofspur,helical, beveland worm gears;belt andchain drives;Flywheels.

UNIT IV **15 Hours**

Singledegree-of-freedomsystems;Naturalfrequencyandcriticaldamping;Forcedvibration;Resonance; Balancing of reciprocating and rotating masses; Torsional vibration and critical speedsofshafts.Casestudiesonautomobilesuspensions,automatictransmissions,materialconveyorsystems,constructionmachinery,etc.

IQAC

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Shigley,J.E.andMischke,C.R.,"MechanicalEngineeringDesign,"McGraw-Hill,1989.*
- *Deutschman,D.,&Wilson,C.E.,"MachineDesignTheory&Practice," Macmillan,1992*
- *Juvinal,R.C.,"FundamentalsofMachineComponentDesign,"JohnWiley,1994.*
- *Spottes,M.F.,"DesignofMachineelements,"Prentice-Hall India,1994.*
- *R. L.Norton, "MechanicalDesign –An IntegratedApproach,"PrenticeHall,2009.*
- *SadhuSingh,"Machine Design",KhannaBookPublishing,2021.*
- *SadhuSingh,"MachineDesign Data Book",KhannaBookPublishing,2022.*

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IQAC

Course Title: **MECHATRONICS,ROBOTICSANDCONTROL**
Course Code: **BME512**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Abilitytorecognizeandanalyze electro-mechanicalsystemsindailylives.
2. Understandthe roleofsensors,actuators,andcontrolsinmechatronicsystems.
3. Familiaritywithcontroltheoryandcontrollerdesign.
4. Understandthemeasurementofvariousquantitiesusinginstruments,theiraccuracy&range,andthetechniquesforcontrollingdevicesautomatically.

CourseContents

UNIT I **10 Hours**

Electro-mechanicalsystems;Typicalapplications;Examples–automobiles,homeappliances, medical instruments, etc.Transductionprinciples;Sensitivity,accuracy,range,resolution,noisesources;Sensorsforcommonengineeringmeasurements–proximity,force,velocity,temperature,etc.;Signalprocessingandconditioning; Selection ofsensors.

UNIT II **15 Hours**

Pneumatic and hydraulic actuators; Electric motors including DC, AC,BLDC, servo and stepper motors; Solenoids and relays; Active materials – piezoelectric and shapememoryalloys.Microprocessors and their architecture; Memory and peripheralinterfacing; Programming; Microcontrollers; Programmable Logic Controllers; PLC principle andoperation;Analog anddigitalinput/outputmodules;Memory module;Timers,internalrelays,counters and data handling; Industrial automation systems; Basic PLC programming; Industry kits(Arduino,RaspberryPi, etc.).

UNIT III **10 Hours**

Robot configurations: serial and parallel; Denavit–Hartenberg parameters;Manipulators kinematics; Rotation matrix, Homogenous transformation matrix; Direct and inverseKinematics for robot position and orientation; Workspace estimation and path planning; Robotvision; Motion tracking; Robot programming and control; Industrial robots - Pick and place robots,sorting,assembly, welding, inspection, etc.

UNIT IV **10 Hours**

Basiccontrolconcepts;Feedback;Openandclosedloopcontrol;Conceptofblockdiagrams;P,PIandPIDcontrollers;Tuningthegainofcontrollers;Systemmodels,transferfunctions,systemresponse,frequencyresponse;RootLocusmethodandBodeplots.Demonstration and projects using simulation software (e.g.,MATLAB,Scilab, ROBODK)forcontrolsystemsand robotics.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *W.Bolton,"Mechatronics,"AddisonWesleyLongman,2010.*
- *J.J.Craig, IntroductiontoRoboticsMechanicsandControl,AddisonWesley,1999.*
- *G.K.McMillan,"Process/IndustrialInstrumentsandControlsHandbook,"McGraw-Hill,1999.*
- *S.Mukherjee,"EssentialsofRoboticsProcessAutomation",KhannaBookPublishing,2021.*

IQAC

Course Title: **MANUFACTURINGPROCESSES**
Course Code: **BME504**

L	T	P	Cr.
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand various manufacturing methods to transform raw materials into finished products through shaping, joining, and finishing.
2. Learn the principles and applications of machining processes such as turning, milling, drilling, and grinding.
3. Examine the Master forming techniques like forging, casting, and sheet metal forming to create complex shapes with desired properties.
4. Explore methods like welding, soldering, and adhesive bonding to efficiently join components into functional assemblies.

CourseContents

UNIT I **16 Hours**

Additive,subtractiveandshapingprocesses;Relativeadvantagesandlimitations;Interdependencyofgeometry,materialandprocess;Effectonproductqualityandcost;Partdesignfor manufacturability;Processselectioncriteria.Metal casting (sand, die and investment casting), Bulkforming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending);Thermoplasticandthermosetplasticprocesses(ex.injectionandblowmolding);Powdermetallurgy;Metalinjection molding; Glass andcompositeprocesses (layup).

UNIT II **16 Hours**

Turning,Drilling,Milling,Grindingandotherfinishingprocesses; Single and multi-point cutting tools; Cutting tool materials; Cutting fluids; Materialremovalrates, surfacefinish, accuracy, integrityand machinabilityAbrasive Jet Machining, WaterJetMachining;UltrasonicMachining;ElectricalDischargeMachining,WireEDM;Electro-ChemicalMachining;LaserBeamMachining,PlasmaArcMachiningandElectronBeam Machining;Microand nano manufacturing.

UNIT III **14 Hours**

Extrusion;vatpolymerization,powderbedfusion;materialjetting, binderjetting; direct energydeposition andlamination processes.Arc welding, gas welding, shielded metal arcwelding; GMAW (MIG) and GTAW (TIG); Brazing and soldering; Solid state joining; Adhesivebonding.

UNIT IV **14 Hours**

Casting–metalflow,solidificationandcooling;applicationtodesignofgatingandfeedingsystemsforqualityand yieldoptimization;OR*Forming*–Plasticdeformationand yieldcriteria; load estimation; OR *Machining* – Orthogonal cutting, various force components; Chipformation,Tool wearandtool life.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *AmitabhaGhoshandA.K.Mallick,ManufacturingScience.AffiliatedEast-WestPressPvt.Ltd.2010.*
- *KalpakjianandSchmid,ManufacturingProcessesforEngineeringMaterials,PearsonIndia,2014*
- *M.P.Groover,FundamentalsofModernManufacturing:Materials,Processes,andSystems*
- *Degarmo*,Black &Kohser,MaterialsandProcessesinManufacturing.

IQAC

Course Title: **MEASUREMENTSANDMETROLOGY**
Course Code: **BME513**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Basic knowledge about measurement systems and their components
2. Various instruments used for measurement of mechanical and electrical parameters
3. Integrate measurement systems for process monitoring and control
4. Design of limits, fits and tolerances for given applications

CourseContents

UNIT I **10 Hours**

Parameters–geometry(straightness,flatness,roundness, etc.), displacement, force, speed, torque, flow, level, pressure, temperature, acceleration,etc.; Definitions: Accuracy, precision, range, resolution, uncertainly and error sources; Regressionanalysis.Structureandexamplesofmeasurementsystems;Calibrationprinciples; Linear andangularmeasurements;Comparators;Gaugedesign;Interferometry.

UNIT II **15 Hours**

Definitions; Tolerance zone and grades, Hole and shaftsystem,Geometrictolerances,Tylor'sprincipleofgauging,Designoftolerancesfor variousapplications; Tolerance analysis in manufacturing and assembly; Role of metrology in Design ofManufacturing.*Dimensional metrology* – Vernier,micrometers, LVDT; *Form metrology* – form tester, surface profiler, CMM, 3D scanning; *Surfacemetrology*– opticalmicroscopes,Laserscanningmicroscopes,electronmicroscopy(SEM/TEM),x-raymicroscopy,Ramanspectroscopy;Tool wear,workpiecequalityand processmetrology.

UNIT III **12 Hours**

Measurement of temperature, thermal conductivityanddiffusivity; Flowobstructionmethods; Magneticflowmeters.Signal generators and analysis; Waveanalyzer;Spectrum analyzer;*Frequency counters* – measurement errors, extending the frequency range; *Transducers* – types,strain gages, displacement transducers; *Digital data acquisition system* - interfacing transducers toelectronicscontrolandmeasuringsystem;Instrumentationamplifier;Isolationamplifier;Computer-controlledtest systems.

UNIT IV **8 Hours**

DOEtechniques;Taguchiorthogonal arrays; Data acquisition, signal processing and conditioning; Error of a system of idealelements; Error probability density function of a system of non-ideal elements; Error reductiontechniques;Qualitycontrol and assurancein industry.

IQAC

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *E.ODoebelinand DhaneshManik,"Measurement Systems",McGrawHill, 2017*
- *Bewoor&Kulkarni,"Metrology&Measurement"TataMcGraw Hill,2009.*
- *D.James,andS,Meadow,"GeometricDimensioningandTolerancing",MarcelDekker,1995*
- *MadhavS.Phadke, QualityEngineeringusingRobustDesign, PrenticeHall,1989*

IQAC

Course Title: **MECHATRONICS,ROBOTICSANDCONTROL LAB**

Course Code: **BME514**

L	T	P	Cr.
0	0	2	1

Total Hours-15

CourseContents

List of Experiments

1. Design and assembly of hydraulic / pneumaticcircuit.
2. Study of power steering mechanism using cut piecemodel
3. Study of reciprocating movement of double acting cylinder using pneumatic directioncontrol valves
4. Use of direction control valve and pressure control valves clamping devices for jig andfixture
5. Study of robotic arm and itsconfiguration
6. Study the robotic endeffectors
7. Study of different types of hydraulic and pneumaticvalves

IQAC

Course Title: **MEASUREMENTS & METROLOGY LAB**
Course Code: **BME515**

L	T	P	Cr.
0	0	2	1

Total Hours-15

CourseContents

List of Experiments

1. Measurement with the help of vernier caliper and micrometer
2. Measurement of an angle with the help of sine bar
3. Measurement of surface roughness
4. Measurement of gear elements using profile projector
5. Three wire method to determine effective diameter of external threads
6. Measurement of thread element by Tool makers microscope
7. Calibration of a pressure gauge with the help of a dead weight gauge tester
8. Use of stroboscope for measurement of speed of shaft
9. Use of pilot tube to plot velocity profile of a fluid through a circular duct
10. Preparation of a thermocouple, its calibration and application for temperature measurement

IQAC

Course Title: **MECHANICAL ENGINEERING LAB-II(DESIGN)**

Course Code: **BME516**

L	T	P	Cr.
0	0	4	2

Total Hours-30

Learning Outcomes:

After completion of this course, the learner will be able tounderstandthe measurementofmechanicalpropertiesofmaterialsandwillbeabletocharacterizethe dynamicbehaviourofmechanicalsystems

CourseContents

1. Uniaxialtensiontestonmildsteel rod
2. Torsiontestonmildsteelrod
3. Impacttestonametallic specimen
4. BrinnellandRockwellhardnesstestsonmetallicspecimen
5. Bendingdeflectionteston beams
6. StrainmeasurementusingRosettestraingauge
7. Microscopicexaminationofheat-treated anduntreatedmetallicsamples
8. Velocityratiosofsimple, compound,epicyclicanddifferential geartrains
9. Kinematicsoffourbar,slidercrank,crankrocker,doublecrank,doublerockerandoscillatingcylindermechanisms
10. Cam&follower andmotionstudies
11. SingledegreeoffreedomSpring-mass-dampersystem,determinationofnaturalfrequencyanddampingcoefficient
12. Determinationoftorsionalnaturalfrequencyofsingleanddoublerotorsystems-undampedanddampednaturalfrequencies

IQAC

Course Title: **PROJECT MANAGEMENT**
Course Code: **BME517**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Differentiate between project, program, and sub-project by identifying contrasting and related characteristics of each utilizing examples from engineering specific industries.
2. Employ an integrated real-world engineering project to create deliverables, such as a work breakdown structure and a project charter, scope statement, project network diagrams and time-driven schedule.
3. Identify each of the following tools, techniques or outputs using an automated project management tool: Critical path; Schedule compression; Crashing; Slack/float; Fast tracking; and Resource leveling
4. Apply project scheduling concepts, geared toward typical Mechanical engineering Concepts, such as Activity Gantt Chart, resource gram/ histogram; resource spreadsheet; and resource-driven schedule through multimedia presentation showing step-by-step procedure.

CourseContents

UNIT I **13 Hours**

Project Management Concepts, Project Planning, Resource Scheduling, Critical Chain Scheduling, Project Quality Management.

UNIT II **10 Hours**

Project performance Measurement and Control, Project Closure/ Termination.

UNIT III **12 Hours**

Managing Project Teams, IT in Projects, International Projects: Issues in managing international projects.

UNIT IV **10 Hours**

Selection and training of employees, cross cultural considerations.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Clifford F Gray, Erik W Larson, "Project Management-The Managerial Process", Tata Mcgraw-Hill Publishing Co Ltd, 2017.*
- *Jack Meredith, Samuel J. Mantel Jr. "Project Management- A Managerial Approach", John Wiley and Sons, 1999.*
- *John M Nicholas "Project Management For Business And Technology" Prentice Hall of India Pvt Ltd*
- *James P Lewis "Project Planning, Scheduling And Control" Tata Mcgraw-Hill*

Publishing Co Ltd.

IQAC

SEMESTER: VI

Course Title: COMPUTERAIDEDDESIGN&ANALYSIS
Course Code: BME611

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand and appreciate use of computer in product development.
2. Apply algorithms of graphical entity generation.
3. Understand mathematical aspects of geometrical modelling.
4. Analysis and use finite element methods for analysis of simple components.

Course Content

UNIT I **10Hours**

Introduction: Roleofcomputersindesignprocess;Computeraideddesign,analysisandmanufacturing; Computer integrated manufacturing; Popular CAD software used in industry; Inputandoutput devices.

Transformations: Matrix representation of points, lines and planes; 2D transformationfor translation, scaling, rotation and reflection; Homogeneous representation & concatenation; 3Dtransformations.

UNIT II **12Hours**

Curves and Surfaces: Representation of curves; Hermite curves, Bezier curves, B-splinecurves,Rationalcurves;Surfacemodelling–parametricrepresentation,planarsurface,surfaceofrevolution, Coons and bicubicpatches,Bezierand B-splinesurfaces.

Solid Modelling: Solid modelling techniques – sweep (linear and curved), Boolean(constructive solid geometry) and other techniques; Solid model representation (Boundary andConstructive Solid Geometry); Medical modelling (pixels, scans and voxels); Exchange standards(IGES,DXF, STEP, STLetc.).

UNIT III **14Hours**

Engineering Analysis: Introduction to finite element method; Principle of potentialenergy; FE analysis of 1D element problems (spring, bar, truss elements); Development of elementstiffness equation and their assembly; Plain strain and plain stress problems; Domain discretization,pre-processing and post-processing; Verification and validation; Popular CAE software used inindustry

Introduction to CFD and HT: Basic theoretical framework, Boundary conditions,ApplicationExamples: thermal and fluid machines.

UNIT IV **10Hours**

Design Optimization: Purpose and application of optimum design, Primary andsubsidiary design equations, Limit Equations, Normal, redundant and incompatible specificationsproblems;Computer-aided designoptimization.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Ibrahim Zeid,"MasteringCADCAM,"TataMcGrawHillPublishingCo.2007.*
- *C.McMohanandJ.Browne,"CAD/CAMPrinciples,"PearsonEducation,2ndEdition,1*

999.
- *GeometricModeling,MichaelE.Mortenson,Tata McGrawHill,2013.*
- *W.M.NeumannandR.F.Sproul,"PrinciplesofComputerGraphics,"McGrawHill,1989.*
- *D.HearnandM.P.Baker,"ComputerGraphics,"PrenticeHall Inc.,1992.*

IQAC

Course Title: MANUFACTURINGAUTOMATION
Course Code: BME612

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understandtheimportanceofautomationin manufacturingvaluechain
2. Gettheknowledge ofvariouselementsof automationtoolsandtechniques
3. Understandtheemergingdigitalmanufacturingtrends
4. Analysis of Manufacturing Automation case studies

Course Content

UNIT I **10Hours**

Introduction: Definition;Reasonsforautomating;Strategies;Typesofautomation;Numericalcontrol(NC,CNC,DNC);IntroductiontoCNCprogrammingandcomputer-aidedprocessplanning.

MachineandProcessAutomation:CNCmachines,Automatedflowlines(types,selection);Workpart transport and transfer mechanisms; Feedback systems and control; Modular and reconfigurablemachines,adaptivemachinecontrols.

UNIT II **11Hours**

Automated Assembly Systems: Historical developments; Choice of assembly methods; Design forautomated assembly;Transfer systems;Vibratory and non-vibratory feeders;Feed tracks, partorientingand placingmechanisms.

Factory Automation: Lean manufacturing, Automation scalability (fixed, programmable, flexibleandreconfigurable);Designandanalysisofautomatedflowlines;Averageproductiontime,productionrate,lineefficiency;Analysisoftransferlineswithoutstorage;Partialandfullautomation.

UNIT III **14Hours**

Automation Tools and Techniques: Mechanical, electro-mechanical, pneumatic and hydraulicsystems; Sensors integration; Process monitoring, data analysis and control using actuators; Robots(pick, place, assembly, welding, painting, etc.); Automatic Guided Vehicles; Automated inspectionand measurement (CMM and 3D Scanning); Machine vision, AI and machine learning; Human-machineinterfaces; Examples and casestudies.

Advanced Automation Trends: Digital, inclusive, smart and distributed manufacturing; Industry4.0; Digital transformations in shop-floors (CIM to Smart factory; Intelligent machines to SmartMachines;Factoryautomation toDistributed automation;Human senseto systemsensed).

UNIT IV **10Hours**

ExamplesandCaseStudies: Pickandplacerobots,testingandsortingbasedsystems,etc;Orientation of parts: in-bowl and out-of-bowl toolings; Manufacturing equipment embedded withdigital data and driven by adoptive controls; Manufacturing automation with autonomous decisionstaken by computers based on the realistic process/machines (production conditions) data

acquiredfromtheresources.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *M. P. Groover, Automation, Production Systems and Computer-integrated Manufacturing,PrenticeHall, 2018.*
- *S.KalpakjianandS.R.Schmid,Manufacturing–EngineeringandTechnology,Pearson.*
- *YoramKoren,Computer ControlofManufacturingSystems,McGrawHill,2005.*
- *CAD/CAMPrinciplesandApplications,P.N.Rao,TataMcGrawHill,2010.*

IQAC

Course Title: PRODUCTION&OPERATIONMANAGEMENT
Course Code: BME613

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Provide knowledge on production management techniques that develop and establishrelationshipbetween market demandand production capability.
2. Understandtheoperation management:Resourceplanningandtheir utility
3. Understand the scientific approach and tools and techniques that assure marketcompetitivenessbyensuringthequality, costand time,
4. Analysis the minimal spanning tree and maximumflowmodel.

Course Content

UNIT I **18 Hours**

Introduction: Scopeofproductionmanagement.Productionsystemandresources(machines,tooling, etc.); Types of production (batch, flow and unit), Roles of line supervisors and productionmanagers.

Project Management: Project life cycle: concept phase (RFQ, Quotations, Proposals), Projectinitiations,DPRpreparation(projectvalue,businesscasedevelopmentandfeasibilitystudy);Projectplanning (obtaining resources, acquiring financing and procuring required materials); Project team,producingqualityoutputs,handlingrisk,acceptancecriteria;Projectexecution(allocationofresources, scheduling, building deliverables); Project Monitoring and control: Project networks,progress review (physical and financial), CPM and PERT, critical path, re-scheduling; Projectclosure: acceptance of project deliverable; Analytics: Performance, capability aggregation, costbenefitanalysis,variabilityanalysis,Output-outcomeanalysis,projectdocumentation,bestpractices,anddepository.

UNIT II **12 Hours**

Production Planning and Control: Production planning, Process planning, Resource planning,demand-utility mapping (production capability index, forecasting models, aggregate productionplanning,materialsrequirementplanning);InventoryManagement:EconomicorderQuantity,discount models, stochastic inventory models, practical inventory control models, JIT; Supply chainandmanagement.

UNIT III **15 Hours**

Factory Management: Factory layout: line balancing, material flow and handling, Lean and greenmanufacturing, Human resource management, Training need analysis, Advantage and opportunitiesfor Digitalization, Advanced factory systems: TQM; Important acts, regularities and safety norms,Reliability assessment of processes, Block chain, Energy management, Efficiency & throughput,Overallequipment effectiveness.Process capability,lean manufacturing.

UNIT IV **15 Hours**

OperationManagement: Linearprogramming,objectivefunctionandconstraints,graphicalmethod, Simplex and duplex algorithms, transportation assignment; Simple queuing theory models;Traveling Salesman problem; Network models: shortest route, minimal spanning tree, maximumflowmodel.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *L.J.KrajewskiandL.PRitzmen,OperationsManagement:StrategyandAnalysis,Pearson,2010.*
- *R.B.Chase,F.R.JacobsandN.J.Aquilano,OperationsManagementforCompetitiveAdvantage,TataMcGrawHill, 2011.*
- *W.J.HoppandM.L.Spearman,FactoryPhysics:FoundationsofManufacturingManagement,McGrawHillInternational Edition,2008.*
- *Mahadevan. B.,OperationsManagement:TheoryandPractice,Pearson,2015.*
- *TahaH.A.,OperationsResearch,6thEdition,PHIIndia,2003.*
- *M.P.Poonia,TotalQualityManagement,Khanna PublishingHouse, 2022.*

IQAC

Course Title: PRODUCTINNOVATION&ENTREPRENEURSHIP
Course Code: BME614

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the importance of entrepreneurship and innovation to creating value
2. Analyze marketing theory and frameworks in formulating entrepreneurship and innovation
3. Construct a marketing plan for new business ventures
4. Evaluate market entry and product/service innovation development

Course Content

UNIT I **15 Hours**

Entrepreneurship: Role of entrepreneurship in economic development; Entrepreneurial mindset,motivation and competencies; Market pull and technology push factors; New product developmentlifecycle; Technology readiness levels; Product-market fit validation; Commercialization pathways;Businessvision &leadership; Team composition &management.

UNIT II **15 Hours**

ProductInnovation:Opportunityscanning,marketsurvey,needidentificationandproblemdefinition;Creativedesignthinkingforconceptgeneration;Detaileddesign&prototyping;Functionality & manufacturability; Bill of materials & components supply chain; Manufacturing &assemblyplan; Producttesting &qualityassurance;Intellectualpropertyrights management.

UNIT III **15 Hours**

Marketing&Finance:Marketsegmentation&marketsizing;Customerpersona&value proposition; Marketing (Go-to-market) strategy; Distribution channels and sales network; Fundingrequirement (based on stage); Source of funding for startup ventures; Financial projections andaccounting;Startup to scaleup financing.

UNIT IV **15 Hours**

Venture Creation: Sustainable business options & pathways; Business model & business canvas;Startupteam&businesspartners;Startupecosystemandstakeholders;Technologybusinessincubators & parks; Proposal pitching & agreements; Startup company incorporation; Social impact&responsibility.

CourseProject:Needidentification,innovativesolution,businessplan,go-to-marketstrategy.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *BillAulet,"TechnologyEntrepreneurship",4th ed.,TataMcGrawHill,2014.*
- *PeterF.Drucker,"InnovationandEntrepreneurship",1st ed.,HarperBusiness,2006.*
- *ChelatBhuvanachandran, Innovision,KhannaBookPublishing,2022.*

- *Byers, Dorf, andNelson, TechnologyVentures:From IdeastoEnterprise, McGrawHill,2010*
- *SteveBlank,"TheStartupOwner'sManual"*
- *T.V.Rao,"Entrepreneurship-ASouthAsianPerspective"*

IQAC

Course Title: MECHANICALENGG.LAB-III(MANUFACTURING)
Course Code: BME615

L	T	P	Credits
0	0	4	2

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand theadvanced manufacturingmethods.
2. Acquire knowledgeofthedimensional &formaccuracyofproducts.
3. Perform some advanced manufacturing operations and also be able to evaluate the accuracy & tolerance of components produced

Course Content

1. Taperturningandexternal threadcuttingusinglathe
2. Contourmillingusingverticalmillingmachine
3. Spurgearcuttinginmillingmachine
4. MeasurementofcuttingforcesinMilling/Turningprocess
5. CNCpartprogramming
6. Drillingofasmall holeusingwire EDM
7. Microprocessorcontrolledpick&placerobot
8. UseofToolMaker'sMicroscope
9. Comparatorandsinebar
10. Surfacefinishmeasurementequipment
11. Borediametermeasurementusingmicrometerand telescopic gauge
12. UseofAutocollimator

IQAC

Course Title: COMPUTER AIDED DESIGN & ANALYSIS LAB
Course Code: BME616

L	T	P	Credits
0	0	2	1

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand and appreciate use of computer in product development.
2. Apply algorithms of graphical entity generation.
3. Understand mathematical aspects of geometrical modelling.
4. Understand and use finite element methods for analysis of simple components.

Course Content

1. Prepare a programme for plotting lines and curves using algorithms learned.
2. Introductory exercise for 3-D modelling.
3. Exercise for advanced 3-D modelling.
4. Exercise for 3-D editing options.
5. Exercise for Assembly modelling.
6. Exercise for surface modelling.
7. Introductory exercise for finite element analysis.

IQAC

Course Title: MANUFACTURING AUTOMATION LAB
Course Code: BME617

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop microcontroller programs to monitor and control the manufacturing systems.
2. Design and develop an automated system for a given industrial application.
3. Select and integrate various components of automation like sensors, actuators, PLC and robots for a given application

Course Content

1. Draw the circuit diagram to operate single acting pneumatic cylinder using 3/2 push button direction control valve.
2. Draw the circuit diagram to operate double acting pneumatic cylinder using 5/2 direction control valve using push button momentary switch/push button latch.
3. Draw the circuit diagram to operate single acting pneumatic cylinder using 5/2 air spring valve & PLC.
4. Draw the circuit diagram to operate double acting pneumatic cylinder using 5/2 air spring valve & PLC.
5. Draw the circuit diagram to operate double acting hydraulic cylinder using 4/2 direction control valve (solenoid control) using push button switch/latch switch.
6. Draw the circuit diagram to operate double acting hydraulic cylinder using 4/2 direction.
7. Draw the circuit diagram to operate double acting hydraulic cylinder using 4/2 direction control valve (solenoid control) using PLC.
8. Draw the circuit diagram to operate double acting hydraulic cylinder using 4/3 direction control valve (solenoid control) using PLC.

Course Title: OPERATION RESEARCH
Course Code: BME618

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply various types of deterministic models like linear programming, transportation model etc.
2. Analysis various types of stochastic models like waiting line model, project line model, simulation etc.
3. Develop the relationship between a linear program and its dual and perform sensitivity analysis.
4. Understand the decision making environment and apply decision making process in the real world situations.

Course Content

UNIT I **11 Hours**

Introduction: Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research:

Linear Programming Problem: Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Special Case of LP Problem, Graphical Sensitivity Analysis.

UNIT II **10 Hours**

Transportation and Assignment: Transportation Problems definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, Unbalanced problems and profit maximization problems. Transshipment Problems. Assignment Problems and Travelling sales man Problem

UNIT III **12 Hours**

Dynamic Programming:

Introduction to deterministic and probabilistic dynamic programming. Solution of simple problems. Advantages of dynamic

Queuing theory:

Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

UNIT IV **12 Hours**

Replacement Models:

Replacement of items that deteriorate, Replacement of items whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with time and value of money also changes, individual replacement policy, group replacement policy.

Network models:

PERT & CPM introduction, analysis of time bound project situations, construction of networks, identification of critical path, slack and floats, crashing of network for cost reduction, resource leveling and smoothening.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Wagner, H.M.(1980). Principles of Operations Research. Prentice Hall.*
- *Gupta, P.K.& Hira, D.S.(1976).Operations Research. S. Chand &Co.*
- *Taha, H.(1999). Introduction to Operation Research. Pearson.*
- *Hillier, F. S. & Lieberman, G. J. (1967). Introduction to Operations Research. San Francisco: Holden-Day.*

IQAC

Course Title: ENGINEERINGPROJECT-1(LITERATUREREVIEW)
Course Code: BME619

L	T	P	Credits
0	0	4	2

Total Hours-30

Course Content

Thiscourseisaimedtoprovidemoreweightageforprojectwork.Theprojectworkcouldbe doneinthe form of a summer project or internship in the industry or even a minor practical project in thecollege. Participation in any technical event/ competition to fabricate and demonstrate an innovativemachineorproduct could beencouraged underthis course.

IQAC

Semester: VII

Course Title: ENGINEERINGPROJECT-II (DESIGN&ANALYSIS)
Course Code: BME713

L	T	P	Credits
0	0	10	5

Total Hours-75

Course Content

Thiscourseisaimedtoprovidemoreweightageforprojectwork.Theprojectworkcouldbe doneinthe form of a summer project or internship in the industry or even a minor practical project in thecollege. Participation in any technical event/ competition to fabricate and demonstrate an innovativemachineorproduct could beencouraged underthis course.

IQAC

IQAC

Course Title: **SUPPLY CHAIN MANAGEMENT**
Course Code: **OEC084**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Knowledge gain about supply chain management concept.
2. Conduct performance measurements of any supply chain.
3. Capable to apply the SCM philosophy in the industry.
4. Conduct of inventory management at inbound & outbound supply chain level
5. Understand the framework and scope of supply chain networks and functions.

Course Contents

UNIT I **12 Hours**

Perspective of Supply Chain Logistics Management. Logistics concept, role and scope; Logistics Environment- Integrating Logistics of Supply, Logistics of Production and Logistics of Distribution. Internal and external factors for logistics strategy, Operational Resources of logistics (personnel, warehouse means of transport, warehouse transport aids, organizational aids, material stocks, and area/ spare).

UNIT II 12 Hours

Effective supply chain management, customer networking and manufacturing, Risk Pooling, Postponement, cross docking in supply chain, CPFR, IT-enabled supply chains value of Information, Coordination in SCM.

UNIT III 10 Hours

Logistics Activity Mix. JIT and Logistics, Synchronized manufacturing. Purchasing and Materials Management. Distributional logistical systems and facilities-single stage or multistage, warehouse(s), their number, location and allocation, Automated Warehousing, Materials Handling and Packaging. Simulation aided planning of conveyor and warehousing systems.

UNIT IV 11 Hours

Supply Chain Logistics Mix Management. Logistical Connectivity: Transportation modes, rate structure, legal aspects; maintenance, spares and repairs; test and support equipment, Routing of freight flows. Management and Organization of the Logistics Systems; Organization,

Information and cost control; Logistical information Systems, Computer aided logistics management. Case Studies.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Sunil Chopra, Peter Meindi and Kalra, "Supply Chain Management , Strategy, Planning, and operation" Pearson Education, 2010*
- *Arvind Jayant, "Industrial Engineering & Operation Management", Studium Press 2019, New Delhi*
- *Srinivasan G.S; "Quantitative models in Operations and Supply Chain Management", PHI, 2010.*
- *James B. Ayers , "Handbook of Supply chain management", St.Lucle press, 2000.*

IQAC

Course Title: SIX SIGMA
Course Code: OEC085

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Discuss the basics of 6 SIGMA
2. Elaborate the DMAIC process of the six sigma
3. To apply the special tools of six sigma

Course Content

UNIT I **6 Hours**

Introduction to six sigma, Indicators of requirement of Six sigma, Elements of six sigma

UNIT II **12 Hours**

Six sigma process – Define phase, Six sigma tools (QFD, SIPOC) – Define phase, Six sigma process – Measure phase, Six sigma tools (CTQ tree, Process capability calculation, Measurement system analysis using gauge R&R) – Measure phase,

UNIT III **12 Hours**

Six sigma process – analyse phase, Six sigma tools (Histogram, box plot, control chart, scatter chart, fish bone diagram, pareto analysis chart, interrelations diagram) – analyse phase,

UNIT IV **15 Hours**

Six sigma special tools (Regression analysis, Hypothesis testing, ANOVA, Multivariate analysis), Six sigma – process improvement, Six sigma tools (Affinity diagram, FMEA, DOE),

Six sigma process – control phase, Six sigma tools (Value stream mapping, control charts, TPM, Poka – yoke), Implementing six sigma

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Forrest W. Breyfogle III, Implementing Six Sigma, John Wiley & Sons, INC., 2nd edition.*
- *Howard S. Gitlow and David M. Levine, Six Sigma for Green Belts and Champions, Pearson Education, Inc., 10th Printing, September 2012.*
- *Evans, J R and W M Lindsay, An Introduction to Six Sigma and Process Improvement, CENGAGE Learning, 3rd Indian reprint.*

- *Montgomery, D C. Design and Analysis of Experiments, 5th edition, Wiley.*
- *Mitra, Amitava. Fundamentals of Quality Control and Improvement, 3rd edition, Wiley India Pvt Ltd.*

IQAC

Semester: VIII

Course Title: ENGINEERING PROJECT-III (PROTOTYPE & TESTING)

Course Code: BME802

L	T	P	Credits
0	0	16	8

Total Hours-100

Course Content

It is intended to start the project work early in the seventh semester and carry out both design andfabricationofamechanicaldevicewhoseworkingcanbedemonstrated.Thedesignis expectedtobecompleted in the seventh semester and the fabrication and demonstration will be carried out in theeighthsemester.

IQAC

Course Title: **TOTAL QUALITY MANAGEMENT**

Course Code: **OEC069**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the basic terminologies and metrics that are used to govern quality management
2. Get a better perspective on quality standards like ISO and quality awards
3. Be able to identify the various metrics that govern quality
4. Elucidate the role and importance of six sigma as a quality measurement tool
5. Identify the various means and techniques for establishing quality in manufacturing, services and IT sector.

Course Contents

UNIT I **12 Hours**

Evolution of Quality: Historical Perspective, Basic Concepts of Quality, Vision, Mission and Objectives of an Organization, Corporate Structure in an Organization and Role of Quality.

Philosophy of TQM: Gurus of TQM- Quality Management Philosophy of Deming and Juran, Deming's Fourteen Points of Quality Management, Ten steps of quality Management of Juran, Crosby's "Absolutes of Quality" and his Fourteen Steps of Quality Management, Integration of Deming, Juran and Crosby's Quality Management Philosophies to TQM, Taguchi's Philosophy of Quality Engineering.

UNIT II **11 Hours**

Components of TQM: Internal Components: Leadership Quality Policy and Statements Organizational Structure Role of HR in TQM, External Components: Customers' Satisfaction Impact on/of- Suppliers, Investors and Society, Contextual application of TQM.

UNIT III **14 Hours**

Analysis & Improve the Quality: Seven QC Tools – Stratification, Check Sheets, Control Chart, Histogram, Pareto Chart, Cause- and-effect diagram & Scatter diagram. New Management and planning tools – 5 Why Analysis, Affinity Diagram, Interrelationship Digraph & Tree Diagram, Matrix Diagram, Matrix Data Analysis, Process Decision Program Chart and Arrow Diagram, Continuous Process Improvements – Benchmarking, PDCA Cycle, 6S, Kaizen, Lean and Six- Sigma principles.

UNIT IV **8 Hours**

Introduction to techniques used in TQM: Six Sigma, Kaizen, 7 Habits of Highly Effective People

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Dale H. Besterfield, Carol Besterfield Michna, Glen Besterfield, Mary Besterfield Sacre, Hemant Urdhwareshe & Rashmi Urdhwareshe "Total Quality Management", Pearson.*
- *Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.*
- *Janakiraman. B and Gopal.R.K., "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.*

IQAC

Profession Elective Course
Group: Technology

Course Title: FINITE ELEMENT ANALYSIS
Course Code: BME901

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe the procedure involved to solve a problem using Finite Element Methods.
2. Examine the element stiffness matrices using different approach.
3. Understand a 2D problem using line, triangular, axisymmetric and quadrilateral element.
4. Examine the theory and characteristics of finite elements that represent engineering structures.

Course Content

UNIT I **12Hours**

Introduction:
Finite element methods, history and range of applications.

Finite Elements:
Definition and properties, assembly rules and general assembly procedure, features of assembled matrix, boundary conditions.

UNIT II **10Hours**

Continuum Problems:
Classification of differential equations, variational formulation approach, Ritz method, element equations from variations. Galerkin's weighted residual approach, energy balance methods.

UNIT III **13Hours**

Element Shapes and Interpolation Functions:
Basic element shapes, generalized coordinates, polynomials, natural coordinates in one-, two- and three-dimensions, Lagrange and Hermite polynomials, two-D and three-D elements for C^o and C^1 problems, Coordinate transformation, iso-parametric elements and numerical integration.

UNIT IV **10Hours**

Applications & Case Studies:
Application of finite element methods to elasticity and structural, heat transfer, fluid-flow, lubrication and general field problems.

Transaction Mode
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

1. Huebner, K.H. (1975). *The Finite Element Method for Engineers*. John Wiley. New York.
2. Jeffery, M.S. (1989). *Applied Finite Element Modeling*. Marcel Dekker. New York.
3. Zienkiewicz, O.C. (2003). *The Finite Element Method*. Tata McGraw Hill. New Delhi.

4. Desai, C.S. (2005). *Introduction to the FEM*. (CBS)-affiliated to East West Press. New Delhi.
5. Buchanan, G. R. (1995). *Finite Element Analysis*. Schaum MGH, New York.

IQAC

Course Title: COMPUTATIONAL FLUID DYNAMIC
Course Code: BME902

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop the governing equations for fluid flow
2. Apply finite difference, finite volume and finite element methods to solve the flow problems
3. Examine the stability and conduct a grid-convergence assessment
4. Evaluate turbulence models to engineering fluid flow problems

Course Content

UNIT I **10 Hours**

Equations of fluid dynamics

Basic concepts Eulerarian and Lagrangian methods of describing fluid flow motion, acceleration and deformation of fluid particle, vorticity. Laws governing fluid motion, continuity, Navier – stokes & energy equations. Boundary layer equation, Euler equations, potential flow equations, Bernoulli's equation and vorticity transport equation. Initial and boundary conditions.Classification of equation of motions – hyperbolic, parabolic, elliptic.

UNIT II **10 Hours**

Mathematical Preliminaries

Numerical integration. Review of linear algebra, solution of simultaneous linear algebraic equations – matrix inversion, solvers – direct methods, elimination methods, ill conditioned systems; Gauss- Sidel method, successive over relaxation method.

UNIT III **12 Hours**

Grid Generation

Transformation of coordinates. General principles of grid generation – structured grids in two and three dimensions, algebraic grid generation, differential equations based grid generation; Elliptic grid generation, algorithm, Grid clustering, Grid refinement, Adaptive grids, Moving grids. Algorithms, CAD interfaces to grid generation. Techniques for complex and large problems: Multi block methods.

Finite difference discretization

Elementary finite difference coefficients, basic aspects of finite difference equations, consistency, explicit and implicit methods, errors and stability analysis.Stability of elliptic and hyperbolic equations. Fundamentals of fluid flow modeling-conservative property, upwind scheme, transporting property, higher order up winding. Finite difference applications in heat transfer – conduction, convection.

UNIT IV **13 Hours**

Finite Volume Method

Introduction, Application of FVM in diffusion and convection problems, NS equations – staggered grid, collocated grid, SIMPLE algorithm. Solution of discretized equations using TDMA.Finite volume methods for unsteady problems – explicit schemes, implicit schemes. Finite Element Method: Introduction. Weighted residual and vibrationalformulations. Interpolation in one-dimensional and two-dimensional cases. Application of FEM to ID and 2D problems in fluid flow and heat transfer

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Ferziger J. H.&Peric, M. (1999). Computational Methods for fluid Dynamics. Springer-Verlag.*
- *Anderson J. (1995). Computational fluid Dynamics. McGraw Hill Inc.*
- *Patankar, S. P. (1980). Numerical Heat Transfer & Fluid flow. CRC Press.*
- *Sunderarajan& Muralidhar, K.(2009). Computational Fluid Flow and Heat Transfer. Narosa Publishing*

IQAC

Course Title: POWERPLANTENGINEERING
Course Code: BME903

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understandtheprinciplesofoperationfordifferentpowerplants and theireconomics.
2. Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
3. Discussing environmental and safety aspects of power plant operation.
4. Basic knowledge of Different types of nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor

Course Content

UNIT I **12 Hours**

Introduction:Powerplants–typesandclassificationbasedonenergysources.

Coal based Thermal Power Plants: Basic Rankine cycle and its modifications; Layout of moderncoal power plant; 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;Binarycycles andcogeneration systems.

UNIT II **10 Hours**

Gas Turbine and Combined Cycle Power Plants: Brayton cycle analysis and optimization;Components of gas turbine power plants; Combined cycle power plants; Integrated Gasifier basedCombinedCycle(IGCC)systems.

UNIT III **13 Hours**

Nuclear Power Plants: Basics of nuclear energy conversion; Layout and subsystems of nuclearpower plants; Boiling Water Reactor (BWR); Pressurized Water Reactor (PWR); CANDU Reactor;Pressurized Heavy Water Reactor (PHWR); Fast Breeder Reactors (FBR); Gas cooled and liquidmetalcooled reactors; Safetymeasures fornuclear powerplants.

HydroelectricPowerPlants: Classification;Typicallayoutandcomponents.

UNIT IV **10 Hours**

RenewablePowerSystems: Principlesofwind,tidal,solarphoto-voltaic,solarthermal,geothermal,biogasand fuel cell powersystems.

Energy Economics and Environment: Economic and environmental issues; Power tariffs; Loaddistribution parameters; Load curve; Capital and operating cost of different power plants; Pollutioncontroltechnologies includingwastedisposaloptions forcoal andnuclearplants.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *NagP.K.,PowerPlantEngineering,3rd ed.,TataMcGraw Hill,2008.*
- *ElWakilM.M.,PowerPlantTechnology,TataMcGrawHill,2010.*
- *ElliotT.C.,ChenKandSwanekampR.C.,Power PlantEngineering,2nd ed.,McGraw Hill,1998.*

IQAC

Course Title: RENEWABLEENERGYENGINEERING
Course Code: BME904

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Acquire knowledge of technical competency combined with research to generate innovativesolutionsin Energyengineering.
2. Prepare the students to exhibit a high level of professionalism, integrity, environmental andsocialresponsibility,andlife-longindependent learningabilitywithenvironment inmind.
3. ApplyandshareindepthknowledgeintheareaofEnergyEngineeringandMa nagement.
4. Abilityto applyengineeringandscientificprinciplesfortheeffectivemanagementofen ergysystems

Course Content

UNIT I **10 Hours**

Introduction: Basic concepts of energy; Introduction to Renewable Energy Technologies; EnergyandEnvironment–globalwarming,acidrains,depletionofozonelayer;GlobalandIndianScenarioofre newableenergysources; Energystorage-necessityandenergystoragemethods.

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal andinclinedsurfaces; Measurement ofsolarradiationdata.

UNIT II **15 Hours**

Solar Thermal Systems: Introduction; Basics of thermodynamics and heat transfer; Flat platecollector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation;Solarcooker; Solarrefrigeration andairconditioning;Thermal energystoragesystems.

SolarPhotovoltaicSystems:Introduction;SolarcellFundamentals;Characteris ticsandclassification;Solarcell: Module,panelandArrayconstruction;Photovoltaicthermalsystems.

UNIT III **10 Hours**

Wind Energy: Introduction; Origin and nature of winds; Wind turbine siting; Basics of fluidmechanics; Wind turbine aerodynamics; wind turbine types and their construction; Wind energyconversionsystems.

Fuelcells:Overview;Classificationoffuel cells;Operatingprinciples; Fuelcellthermodynamics.

UNIT IV **10 Hours**

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomassconversiontechnologies;Urbanwastetoenergyconversion;Biomassgasi fication.

Other forms of Energy: Introduction: Nuclear, ocean and geothermal energy applications; Originandtheirtypes; Working principles.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *O.P.Gupta,"EnergyTechnology",KhannaBookPublishing,NewDelhi.*
- *V.V.N.Kishore,"RenewableEnergyEngineeringandTechnology:Principlesa ndPractice,"Routledge,1st Edition, 2019.*
- *N.JenkinsandJ.Ekanayake,"RenewableEnergyEngineering,"Cambridge UniversityPress,1stEdition, 2017.*
- *G.Boyle,"RenewableEnergy,"OUPOxford,2ndEdition,2009.*

IQAC

Course Title: DESIGN FOR MANUFACTURING & ASSEMBLY
Course Code: BME905

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identifyprimaryandsecondarycomponentsthroughfunctional analysis
2. Calculatethedesignefficiencyfortheirproductdesign
3. Identifyvariousdesignrecommendationofdesignprocess
4. Analyzeandderivethegripping,insertionandfixingvaluesthroughfittinganalysisoftheproduct

Course Content

UNIT I **10 Hours**

Introduction: Design philosophy steps in design process, general design rules for manufacturability, basic principlesofdesignLingforeconomicalproduction,creativityindesign;Materialsselectionofmaterialsfordesigndevelopmentsin materialtechnology,criteriaformaterialselection,materialselection interrelationshipwithprocess selectionprocessselectioncharts.

UNIT II **13 Hours**

Machiningprocess:Overviewofvariousmachiningprocesses,generaldesignrulesformachining,dimensional toleranceandsurfaceroughness,designformachining,easeofredesigningofcomponentsformachiningeasewithsuitableexamples. General designrecommendationsformachined parts

Metal casting: Appraisal of various casting processes, selection of casting processes, general design considerationsforcasting,castingtolerances,useofsolidificationsimulationincasting design,productdesignrulesforsandcastingMetaljoining:Appraisalofvariouswelding processes,factorsindesignofweldments,generaldesignguidelines,preand posttreatmentof welds, effectsofthermalstressesinweld joints, designofbrazed joints

UNIT III **12 Hours**

Forging, design factors for forging, closed dies forging design, parting lines of die drop forging die design generaldesign recommendations. extrusion and sheet metal work: Design guidelines for extruded sections, design principlesforpunching,blanking,bending,deepdrawing,KeelerGoodmanforminglinediagram,componentdesignfor blanking.

UNIT IV **10 Hours**

Designforassembly:Generaldesignguidelinesformanualassembly,developmentofsystematicDFAmethodology,assembly efficiency, classification system for manual handling, classification system formanual insertion andfastening,effectofpartsymmetry onhandlingtime.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Geoffrey Boothroyd, ―Assembly Automation and Product Design‖, Marcel Dekker Inc., NY, 1st Edition,2013.*
- *GeorgeE,Dieter,―EngineeringDesign-Material&ProcessingApproach‖,McGraw-Hill,2ndEdition,2000.*
- *GeoffreyBoothroyd,―HandBookofProductDesign‖,MarcelandDekken,1stEdition ,2013.*
- *GeoffreyBoothroyd,PeterDewhurst,Winston―ProductDesignforManufacturing andAssembly‖,CRCPress,1stEdition,2010.*
- *GeoffreyBoothroyd,―HandBookofProductDesign‖,MarcelandDekken,1stEdition ,2013.*
- *GeoffreyBoothroyd,PeterDewhurst,Winston―ProductDesignforManufacturing andAssembly‖,CRCPress,1stEdition,2010*

IQAC

Course Title: ADDITIVE MANUFACTURING PROCESSES
Course Code: BME907

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the working principle and process parameters of AM processes
2. Explore the applications of AM processes in various fields
3. Select the suitable material and process for fabricating a given product
4. Apply the knowledge in Material science in Additive Manufacturing Components.

Course Content

UNIT I **10 Hours**

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM. Vat Photo polymerization AM Processes: Stereo lithography (SL), Materials, Process Modelling, SL resin curing process, SL scan patterns, Micro-stereo lithography, Mask Projection Processes, Two-Photon vat photo polymerization, Process Benefits and Drawbacks, Applications of Vat Photo polymerization, Material Jetting and Binder Jetting AM Processes.

UNIT II **10 Hours**

Extrusion - Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, BioExtrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes. Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications

UNIT III **12 Hours**

Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process 11 Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.

UNIT IV **13Hours**

Directed Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Processing-structureproperties, relationships, Benefits and drawbacks, Applications of Directed Energy Deposition Processes. Materials science for AM - Multifunctional and graded materials in AM, Role of solidification rate, Evolution of nonequilibrium structure, microstructural studies, Structure property relationship.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", 2nd Edition, Springer, 2015.*
- *Patri K. Venuvinod and Weiyin Ma, "Rapid Prototyping: Laser-based and Other Technologies", Springer, 2004.*
- *Chua Chee Kai, Leong Kah Fai, "3D Printing and Additive Manufacturing: Principles & Applications", 4th Edition, World Scientific, 2015.*
- *D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001.*

- *Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006*

IQAC

Course Title: DIE, MOLD AND TOOL ENGINEERING
Course Code: BME908

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand of fixturing and workholding during machining processes.
2. Provide an understanding of the metallurgy, processing, and types of tool steels, including heat treatment.
3. Acquire knowledge an introduction to dies and molds for forming processes in both the liquid and solid states.
4. Basic understanding of the economics of tooling: break even analysis, number of mold or die cavities, comparison of production processes based on production run.

Course Content

UNIT I **12 Hours**

CuttingToolDesign

Fundamentals of Cutting tools design, cutting tools and their principalelements,Toolgeometry,systemofnomenclaturesandtheirinterrelations,settingforthegrindingofvariousbasiccuttingtool (turning,drilling,milling).

AnalysesandDesignofJigsandFixture

Principles of jig and fixture design, Dual cylinder location, diamond pinanalysis,V-block analysis, design principlesofcentralizers, variousmechanisms and design of equalizers, analysis for optimum number ofclamping forces required and calculation of theirmagnitudes, conceptofmodularfixtures,designoffixturesforNC/CNCmachines,computer Applicationsinfixturedesignandanalysis

UNIT II **11Hours**

Designofpresstools:

Components of die design, design of die blocks, punches and strippers,methods of holding punches, sketches of stock stops, Design procedurefor progressive dies, compound dies and combination dies for press tooloperationforgingdiedesignfordropandmachineforgingparts. Computerapplicationsinpresstool design.

UNIT III **12 Hours**

Designofforgingdies:

Grain flow considerations, parting line selection, draft, design problemsinvolving ribs, bosses and fillets. Flash and flash control, determinationof number of impressions required and their sequence, design steps andanalysisofforgingdies,detailcalculations,shrinkage,cavityshapes, heattransferconsiderations,coolingandejectionsystems,automation in forgingoperations,computer aideddesignandanalysis.

UNIT IV **10Hours**

Designofinjectionmolds

Principles of melt processing, product considerations, determination ofeconomical number of cavities, temperature control of injection molds,calculation of mold opening force and ejection force. Detail design ofcoolingsystem,ejectionsystemandgatingsystem.Moldability features,moldflowanalysis

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Cole:"ToolDesign" , 1970.*
- *Donaldson:"ToolDesign",TataMcGrawHill, 2012.*
- *ASTEM:"FundamentalsofTool Design", 2010.*
- *P.C.Sharma:"ATextbookofProductionEngineering".,S.ChandPublication,N.Delhi, 1999.*
- *IvanaSuchy,"HandbookofDieDesign",2ndeditionMcGrawHill, 2006.*
- *Ventatraman,"DesignofJigs,FixturesandPressTools",AscentSeriesTataMcGrawHill.*
- *DeshpandeD.L.,"BasicTools",2ndeditionUniversityPress.*

IQAC

Profession Elective Course
Group: IndustrySector

Course Title: AUTOMOBILE ENGINEERING
Course Code: BME909

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the functioning of automobiles,maintenance and their manufacturing.
2. Examine the servicing of automobiles or trading/ manufacturing of auto components this helps to make skillful.
3. Illustrate the types of air compressors, working principle of two stroke and four stroke engines.
4. Differentiate the operating characteristics of common internal combustion engines.

Course Contents

UNIT I10Hours

Vehicle Structure andEngines

Types of Automobiles - Vehicle Construction – Chassis – Frame and Body – Aerodynamic forces.Engine components, Materials and functions - Cooling and Lubrication systems in engines – Turbo Chargers – Engine Emission Control by three way Catalytic converter – Electronic Engine Management System.

UNIT II10 Hours

Engine Auxiliary Systems

Carburetor–working principle - Electronic fuel injection system – Mono-point and Multi - Point Injection Systems – Construction, Operation and Maintenance of Lead Acid Battery - Electrical systems – Battery generator – Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type) - Regulators-cut outs.

UNIT III

10HoursTransmission Systems

Clutch – Types and Construction – Gear Boxes, Manual and Automatic – Floor Mounted Shift Mechanism – Over Drives – Fluid flywheel - Torque converters– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive – Introduction to rear wheel drive.

UNIT IV 15

Hours1.Steering, Brakesand Suspension

Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry and Types of steering gear box– Power Steering – Types of Front Axle – Suspension systems – Braking Systems – Types and Construction – Diagonal Braking System – Antilock Braking System.

2. **Alternative Energy Sources**

Use of Natural Gas, LPG, Biodiesel, Alcohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells – Introduction to off road vehicles.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Crouse, W.H. (1965). Automotive Mechanics.Tata McGraw Hill.*
- *Singh, K.(2009).Automobile Engineering(Vol. I & II).Standard Publishers.*
- *Newton, K., Steeds, W. & Garrett, T.K. (1996). The Motor Vehicle. Butterworth International.*
- *Heitner, J.(2004).Automotive Mechanics. EastWest Press.*
- *Gupta, R.B.(2016).Automobile Engineering. Satya Prakashan publications.*

IQAC

Course Title: AEROSPACE ENGINEERING
Course Code: BME910

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply a deep working knowledge of technical fundamentals to solve engineering problems and address society's needs in aerospace and related areas for the nation and the world.
2. Understand technical, business, societal, and other contexts; demonstrate a commitment to ethical action; and continue to strengthen technical, professional, and personal skills.
3. Communicate and collaborate effectively as members of multidisciplinary teams.
4. Design, implementation, and operation of innovative technologies, products, processes, and systems in aerospace and related areas for the nation and the world.

Course Contents

UNIT I **8 Hours**

History of flights; Anatomy of flight vehicles.

UNIT II **13 Hours**

Engine Auxiliary Systems

Classification of aircraft and spacecraft;Atmosphere and flying weather; Airfoil and wing aerodynamics; Aerodynamic forces, lift anddrag, high lift devices.

UNIT III **12 Hours**

Aircraft performance–takeoff and landing, cruising, climbing, glidingand turning flights, range and endurance, ceiling, flight envelope; Principles of stability andcontrol.

UNIT IV **12 Hours**

Aerospace propulsion systems; Elements of structures and materials; Airplanes ofthefuture;Hypersonic vehicles; Basics ofspaceflight;Indianaerospacescenario.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *J. D. Anderson,Jr.,IntroductiontoFlight,McGrawHill, 2000.*
- *R.A.Shevell, Fundamentalsof Flight,PearsonEducation,1989.*
- *C.Kermode,Mechanicsof Flight,Longman,1996.*
- *L.J.Clancy,Aerodynamics,HimalayanBooks,1996.*
- *S.K.Ojha,FlightPerformanceofAircraft,AIAASeries,1997.*
- *J.J.Sellers,UnderstandingSpace:AnIntroductiontoAstronautics,McGrawHill,2005.*

Course Title: AGRICULTURE ENGINEERING
Course Code: BME911

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Differentiate primary and secondary tillage; identify tillage implements associated with either the primary or secondary tillagecategory.
2. Understand why a producer might do conservation vs. conventional tillage.
3. Describe strip tillage, ridge tillage, no-tillage, mulch tillage, and vertical tillage.
4. Perform all pre-inspection and operations of at least two different types of farmmachinery

Course Contents

UNIT I **10 Hours**

Status of Farm Power in India, Sources of Farm Power , I.C. engines, workingprinciplesofICengines,comparisonoftwostrokeandfourstrokecycleengines,Studyof differentcomponentsofI.C.engine,
I.C.engineterminologyandsolvedproblems.

UNIT II **13 Hours**

Engine Auxiliary Systems

Familiarizationwithdifferentsystemsof
I.C.engines:Aircleaning,cooling,lubrication,fuelsupplyandhydrauliccontrolsystemofatractor,
FamiliarizationwithPowertransmissionsystem:clutch,gearbox,differentialandfinaldriveofatractor.

UNIT III **11 Hours**

Tractortypes,Costanalysisoftractorpowerandattachedimplement,Familiarization with Primary and Secondary Tillage implement, Implement forhillagriculture,implementfor Interculturaloperations.

UNIT IV **11 Hours**

Familiarization with sowing and planting equipment, calibration of a seed drillandsolvedexamples,FamiliarizationwithPlantProtectionequipment,Familiarizationwith harvestingandthreshingequipment.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *JagadishwarSahay-ElementsofAgriculturalEngineering,2006.*
- *SurendraSingh.FarmMachinery-PrinciplesandApplications.ICARPublication.*
- *S.C.JainandC.R.Rai.FarmTractor–MaintenanceandRepair.StandardPublishers,1705-B,NaiSarak,Delhi–110006.*
- *Ojha,T.P.and Michael,A.M.PrinciplesofAgriculturalEngineering.Vol.I, JainBrothers,16/893, East ParkRoad,KarolBagh,NewDelhi–110005.*

Course Title: **BIOMEDICAL ENGINEERING**
Course Code: **BME306**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Gain expertise in designing and developing medical devices and instruments for diagnosis, monitoring, and treatment.
2. Understand the mechanics of biological systems, studying movement and forces in the context of human physiology.
3. Explore the selection and development of materials for implants and medical devices compatible with living tissues.
4. Learn about medical imaging technologies like MRI, CT, and ultrasound, used for visualization and diagnosis.

CourseContents

UNIT I **10 Hours**

Introduction to Medical Instruments and Devices, Principles and Applications. Fundamentals of Anatomy and Physiology in Biomedical Engineering. Biomaterials and their Classification for Medical Applications. Medical Imaging Techniques: X-ray, MRI, CT, Ultrasound, and their Principles. Basic Principles of Biomechanics in Biomedical Engineering.

UNIT II **10 Hours**

Biomechanics: Kinematics and Dynamics of Human Movement. Medical Electronics: Sensors, Signal Processing, and Instrumentation. Diagnostic Techniques: Electrocardiography (ECG), Electroencephalography (EEG), and Electromyography (EMG). Principles of Medical Imaging and Image Processing. Design and Evaluation of Medical Devices: Safety and Regulatory Considerations.

UNIT III **10 Hours**

Medical Signal Processing: Analysis and Interpretation of Physiological Signals. Biomedical Instrumentation: Measurement Techniques and Transducers. Introduction to Biomedical Sensors and Biosensors. Medical Data Acquisition and Processing. Patient Monitoring Systems and Telemedicine Applications.

UNIT IV **15 Hours**

Biomedical Image Analysis: Image Enhancement, Segmentation, and Feature Extraction. Digital Image Processing in Medical Imaging: Applications and Techniques. Medical Imaging Modalities: Ultrasound, MRI, PET, SPECT, and CT. Medical Image Reconstruction Techniques: Tomography and 3D Imaging. Emerging Trends in Biomedical Engineering: Wearable Health Technologies and Point-of-Care Devices.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *"Introduction to Biomedical Engineering" by John Enderle, Susan M. Blanchard, Joseph D. Bronzino, 2005.*
- *"Biomechanics: Concepts and Computation" by Cees Oomens, Marcel Brekelmans, Frank Baaijens, 2018.*
- *"Medical Instrumentation: Application and Design" by John G. Webster, 2009.*
- *"Medical Imaging Signals and Systems" by Jerry L. Prince, Jonathan Links, 2006.*
- *"Biomedical Signal Processing: Principles and Techniques" by Rangaraj M. Rangayyan, 2002.*
- *"Digital Image Processing" by Rafael C. Gonzalez, Richard E. Woods, 2008.*

IQAC

Course Title: **FOOD TECHNOLOGY**
Course Code: **BME913**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply scientific principles to analyze and understand the composition, quality, and safety of food products.
2. Evaluate and implement food preservation methods to extend shelf life and maintain product quality.
3. Demonstrate knowledge of food regulations, labeling requirements, and ethical considerations in the food industry.
4. Design and innovate food products, considering consumer preferences, sustainability, and technological advancements.

CourseContents

UNIT I **12 Hours**

Food Chemistry: Macronutrients and Micronutrients, Chemical Reactions in Food Processing, Enzymes in Food Systems. Food Microbiology: Microbial Spoilage, Pathogens, Microbial Growth Factors. Food Preservation Techniques: Heat Processing, Refrigeration, Freezing, Drying, Fermentation.

UNIT II **12 Hours**

Food Engineering Principles: Heat and Mass Transfer in Food Processing, Fluid Flow, Unit Operations in Food Industry. Food Processing Technologies: Thermal Processing, Mixing, Separation, Size Reduction, Extrusion. Food Packaging: Types of Packaging Materials, Packaging Design, Shelf-Life Extension

UNIT III **10 Hours**

Food Quality and Safety: Quality Parameters, Sensory Evaluation, Quality Control Methods. Food Additives: Types, Functions, Regulations. Food Analysis Techniques: Proximate Analysis, Instrumental Methods for Food Analysis, Chromatography. Food Laws and Regulations: International and National Food Standards and Regulations.

UNIT IV **11 Hours**

Food Product Development: Formulation, Sensory Analysis, Nutritional Labeling. Food Biotechnology: Applications in Food Processing, Genetic Modification. Food Supply Chain Management: Procurement, Storage, Distribution, Logistics. Emerging Trends in Food Technology: Functional Foods, Sustainable Food Processing.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *"Food Processing Technology: Principles and Practice" by P.J. Fellows, 2009.*
- *"Food Science" by Norman N. Potter and Joseph H. Hotchkiss, 1999.*
- *"Introduction to Food Engineering" by R. Paul Singh and Dennis R. Heldman, 1984.*
- *"Food Microbiology: An Introduction" by Thomas J. Montville, Karl R. Matthews, and Yvonne Schäfer, 2020.*
- *"Food Packaging: Principles and Practice" by Gordon L. Robertson, 2016.*

IQAC

Course Title: **MARINE ENGINEERING**
Course Code: **BME914**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Acquire a solid understanding of various marine propulsion systems, including engines and propellers, enabling the analysis and optimization of ship propulsion performance.
2. Expertise in international maritime regulations and safety standards, allowing the implementation of safety measures, adherence to regulations, and effective management of shipboard safety.
3. Develop the skills to comprehend, operate, and maintain marine auxiliary systems such as steering gear, bow thrusters, pumps, and electrical systems, ensuring the efficient operation of shipboard equipment

CourseContents

UNIT I **10 Hours**

Marine Propulsion Systems: Types and Characteristics of Marine Engines, Propeller Types and Performance, Engine Performance Analysis. Marine Power Generation: Shipboard Power Plants, Diesel Generator Operation, Power Distribution.

UNIT II **15 Hours**

Marine Heat Transfer: Heat Exchangers, Cooling Systems, Thermal Efficiency Enhancement. Ship Stability: Centre of Gravity, Centre of Buoyancy, Stability Criteria. Ship Construction: Shipbuilding Materials, Structural Components, Welding Techniques.

UNIT III **10 Hours**

Marine Auxiliary Systems: Steering Gear, Bow Thrusters, Marine Pumps, Compressed Air Systems. Ship Hydrodynamics: Resistance and Propulsion, Hydrodynamic Performance Analysis. Marine Electrical Systems: Power Generation and Distribution, Electrical Machinery.

UNIT IV **10 Hours**

Marine Safety and Regulations: International Maritime Organization (IMO) Regulations, SOLAS Convention, Shipboard Safety. Marine Automation and Control: Engine Control Systems, Alarm and Monitoring Systems. Marine Pollution Prevention: Environmental Regulations, Ballast Water Management.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *"Marine Engineering: Principles and Practice" by Anthony F. Molland, 2011.*
- *"Introduction to Marine Engineering" by D.A. Taylor, 2014.*
- *"Reeds Vol 12 Motor Engineering Knowledge for Marine Engineers" by Paul Anthony Russell, 2012.*
- *"Marine Diesel Engines: Maintenance and Repair Manual" by Jean-Luc Pallas, 2006.*
- *"Ship Construction" by David J. Eyres, 2006.*

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IQAC

Course Title: **NUCLEAR ENGINEERING**
Course Code: **BME915**

L	T	P	Cr.
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Acquire a solid understanding of various marine propulsion systems, including engines and propellers, enabling the analysis and optimization of ship propulsion performance.
2. Gain expertise in international maritime regulations and safety standards, allowing the implementation of safety measures, adherence to regulations, and effective management of shipboard safety.
3. Develop the skills to comprehend, operate, and maintain marine auxiliary systems such as steering gear, bow thrusters, pumps, and electrical systems, ensuring the efficient operation of shipboard equipment

CourseContents

UNIT I **10 Hours**

Nuclear Physics Fundamentals - Particle structure, nuclear forces, and radioactive decay. Nuclear Reactions and Interactions - Cross sections, reaction mechanisms, and neutron interactions with matter. Nuclear Energy - Fission and fusion processes, energy release, and fuel cycles. Radiation Detection and Measurement - Principles of radiation detection, detectors, and dosimetry. Nuclear Reactor Types - Overview of reactor types, their operation, and safety considerations

UNIT II **15 Hours**

Nuclear Reactor Kinetics - Reactor dynamics, reactivity, and control mechanisms. Neutron Transport Theory - Neutron diffusion equation, boundary conditions, and solutions. Neutron Moderation and Absorption - Moderating materials, resonance absorption, and thermalization. Reactor Safety Analysis - Safety systems, accident scenarios, and containment strategies. Reactor Shielding - Radiation shielding materials, calculations, and design considerations.

UNIT III **10 Hours**

Nuclear Fuel Cycle - Uranium enrichment, fuel fabrication, and spent fuel management. Radioactive Waste Management - Classification of waste, disposal methods, and environmental impact. Nuclear Instrumentation and Control - Control systems, instrumentation, and reactor operation. Nuclear

Thermal Hydraulics - Heat transfer, coolant flow, and safety analysis in reactor systems. Radiation Protection and Shielding - Design of shielding, radiation exposure limits, and occupational safety.

UNIT IV **10 Hours**

Nuclear Power Economics - Cost analysis, economics of nuclear power plants, and public perception. Nuclear Regulations and Licensing - Regulatory framework, licensing procedures, and safety regulations. Emerging Nuclear Technologies - Advanced reactor designs, fast reactors, and thorium-based reactors. Nuclear Non-Proliferation - Treaty obligations, safeguards, and preventing nuclear weapons proliferation. Fusion Energy - Basic principles of fusion, research reactors, and potential for commercial fusion energy production.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *"Introduction to Nuclear Engineering" by John R. Lamarsh and Anthony J. Baratta, 2001.*
- *"Nuclear Reactor Physics, Second Edition" by Weston M. Stacey, 2007.*
- *"The Physics of Nuclear Reactors" by Serge Marguet, 2011.*
- *"Introduction to Nuclear Engineering, Third Edition" by John R. Lamarsh and Anthony J. Baratta, 2001.*
- *"Fundamentals of Nuclear Reactor Physics" by Elmer E. Lewis, 2008.*