G.H. Raisoni College of Engineering and Management, Wagholi, Pune – 412 207

(An Autonomous Institute Affiliated to SPPU, Pune)

Second Year B.Tech Mechanical Engineering

(Course 2017)

Course Book

(With effect from June 2017)

Prepared by,

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Dr. Jaywant B. Sankpal (Director)

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DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To produce excellent Mechanical Engineering graduates to cater the needs of Indian industries to face Research challenges.

MISSION

Our efforts are dedicated towards

1. To imparting quality education through strengthening teaching learning process.
2. Creating competency in core Mechanical Engineering and Computer Aided Engineering.
3. To prepare students for accepting industrial and research challenges through project based learning.
4. To prepare professional engineers having lifelong learning ability and ethical values towards society and environment.

INTRODUCTION

GHRCEM, Pune is nationally acclaimed Institute that aims at creating professionals who will be driven by a firm commitment to excellence, yet rooted in the rich cultural heritage of our nation. GHRCEM, Pune is accredited by National Assessment and Accreditation Council (NAAC), Government of India. This Institute has also been granted autonomy by UGC. GHRCEM, Pune is fast emerging as a pioneering Research cum Teaching Institution molding a new generation of engineers, managers, scientists and entrepreneurs of caliber and character.

The Department of Mechanical Engineering was established in year 2006. Presently the department has well equipped laboratories, including state of art equipment's like CNC Trainer machine, CAD/CAM/CAE software etc. The department organizes Guest Lectures to students, Training services. Faculty of mechanical department organizes and participates in national/international conferences, workshops and seminars. The department has SAE, MESA, ISTE Chapters for professional growth and activities. The students of Mechanical Engineering have been recruited by renowned companies like Engineers India Limited, Infosys, NTPC, Tata Motors etc. They have also brought laurels to the department by winning various competitions of national level (BAJA SAE, SUPRA) co-curricular and extracurricular activities like paper presentations, projects, quizzes, sports etc. The department has organized National and International conference during NCRDME 2012-13, ICRAME 2014-15, NCRDME 2016-17. Department has approved Ph.D. research Centre w.e.f. 2014 under UOP Pune. The Institute offers a fulltime programme of 4-years in Mechanical Engineering and the Programme offered list is given below:

Program Offered

Sr. No.	Programme Level	Name of Course	Course Type	Medium of Instruction	Course Establishment	Sanctioned Intake
1	UG B. Tech	1st year	Regular Shift	English	2006-2007	120
		Direct 2nd year	Regular Shift	English	2007-2008	60
2	PG M. Tech	Heat Power	Regular Shift	English	2011-2012	18
		CAD CAM	Regular Shift	English	2014-2015	24
3	Ph. D	Mechanical	Regular Shift	English	2014-2015	-

PROGRAM EDUCATIONAL OBJECTIVES

The graduate shall

1. Demonstrate core mechanical engineering skills to solve industrial problems.
2. Be able to apply analytical and soft skills while serving the industry and society at large.
3. Be able to deliver professional duties and responsibility in team effectively.
4. Be able to demonstrate lifelong abilities and ethical values looking at environmental issues.

LIST OF PROGRAM SPECIFIC OUTCOMES (PSOs)

At the end of graduation:

1. Able to grasp comprehensive and apply the knowledge of mechanical engineering acquired through core courses of engineering.
2. Will be able to apply design, develop and manufactures skills to solve the real life problems associated with industries.
3. Able to use knowledge of soft skills like software tools and multidisciplinary skills to modify and develop new products.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineeringfundamentals and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problemsand design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge andresearch methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, andmodern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge toassess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineeringsolutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities andnorms of the engineering practice.

9**. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.**Projectmanagement and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12.**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Code

B. TECH. MECHANICAL ENGINEERING S.Y-SEMESTER-III

S.NO	COURSE CODE	COURSE NAME	SEM	SCHEME	SUBJECT	ELECTIVE	OFFER
1	BEML202	ENGINEERNG MATHEMATICS-III	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
2	BMEL201	Machine Drawing	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
3	BMEP201	Computer Aided Machine Drawing	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
4	BMEL202	Fluid Mechanics	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
5	BMEP202	Fluid Mechanics	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
6	BMEL203	Materials Engineering	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
7	BMEP203	Materials Engineering	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
8	BMEL204	Kinematicsof Machines	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
9	BMEL205	Engineering Thermodynamics	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes

S.NO	COURSE CODE	COURSE NAME	SEM	SCHEME	SUBJECT	ELECTIVE	OFFER
10	BMEP205	Engineering Thermodynamics	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
11	BMEGP202	General Proficiency-II	III	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	AUDIT COURSE	No	Yes

B. TECH. MECHANICAL ENGINEERING S.Y-SEMESTER-IV

S.NO	COURSE CODE	COURSE NAME	SEM	SCHEME	SUBJECT	ELECTIVE	OFFER
1	BEML212	Applied Numerical Methods and Optimization	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
2	BEMP212	Applied Numerical Methods and Optimization	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
3	BMEL206	Mechanics of Material	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
4	BMEL207	Manufacturing Process-I	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
5	BMEP207	Manufacturing Process-I	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
6	BMEL208	Mechatronics	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
7	BMEP208	Mechatronics	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
8	BMEL209	Fluid Machinery	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	THEORY	No	Yes
9	BMEP209	Fluid Machinery	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	PRACTICAL	No	Yes
10	BMEP210	Industrial safety practices and work culture	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	AUDIT COURSE	No	Yes
11	BMEGP203	General Proficiency-III	IV	UG MECHANICAL ENGINEERING 2017-18 [AUTONOMOUS]	AUDIT COURSE	No	Yes

Course Structure
S.Y (B.Tech.)-MECH

DEPARTMENT OF MECHANICAL ENGINEERING

Scheme of B.Tech (MECHANICAL ENGINEERING)

SEMESTER-III

Sub.Code	Nameofthe Course		TeachingScheme				Credits	EvaluationScheme						
								Theory			Practical		Total	Duration Ofpaper (hrs)
			Th	Tu	Pr	Total		TAE (20)	CAE (20)	ESE (60)	ConAss	Ext. Oral		
SEM-III														
BEML202	Engineering Mathematics-III		3	1	-	4	4	20	20	60	-	-	100	3
BMEL201	Machine Drawing		3	-	-	3	3	20	20	60	-	-	100	3
BMEP201	Computer Aided Machine Drawing		-	-	2	2	1	-	-	-	25	-	25	-
BMEL202	Fluid Mechanics		3	-	-	3	3	20	20	60	-	-	100	3
BMEP202	Fluid Mechanics				2	2	1	-	-	-	-	25	25	-
BMEL205	Engineering Thermodynamics		3	-	-	3	3	20	20	60	-	-	100	3
BMEP205	Engineering Thermodynamics		-	-	2	2	1	-	-	-	-	25	25	-
BMEL203/ BMEL207	Materials Engineering/ Manufacturing Process-I		3	-	-	3	3	20	20	60	-	-	100	3
BMEP203/ BMEP207	Materials Engineering/ Manufacturing Process-I		-	-	2	2	1	-	-	-	25	-	25	-
BMEL204/ BMEL206	Kinematics of Machines/Mechanics of Material		3	1	-	4	4	20	20	60	-	-	100	3
BMEGP202/ BMEGP203	General Proficiency-II/ General Proficiency-III	II	1	-	2	3	Audit Course	-	-	-	G	-	-	-
		III	-	-	2	2	Audit Course	-	-	-	G	-	-	-
	Total		18	2	10	30	24	120	120	360	50	50	700	-

TAE – Teachers Assessment Evaluation
CAE – Class Assessment Examination
ESE – End Semester Examination
Cont. Ass – Continuous Assessment

Th - Theory
Tu – Tutorial
Pr – Practical
Ext – External

*TAE will be based on Home Assignment, Seminar, Quiz, Surprise Test, Group Discussion, Debate, General Behavior, Attentiveness and Attendance

DEPARTMENT OF MECHANICAL ENGINEERING

Scheme of B.Tech (MECHANICAL ENGINEERING)

SEMESTER-IV

Sub.Code	Nameofthe Course		TeachingScheme				Credits	EvaluationScheme						
								Theory			Practical		Total	Duration of paper (hrs)
			Th.	Tu	Pr.	Total		TAE (20)	CAE (20)	ESE (60)	Cont. Ass	Ext. Oral		
SEM-IV														
BEML212	Applied Numerical methods & Optimization		3	-	-	3	3	20	20	60	-	-	100	3
BEMP212	Applied Numerical methods & Optimization		-	-	2	2	1	-	-	-	25	25	50	-
BMEL208	Mechatronics		3	-	-	3	3	20	20	60	-	-	100	3
BMEP208	Mechatronics		-	-	2	2	1	-	-	-	25	25	50	-
BMEL209	Fluid Machinery		4	-	3	4	4	20	20	60	-	-	100	3
BMEP209	Fluid Machinery		-	-	2	2	1	-	-	-	-	25	25	-
BMEP210	Industrial safety practices andworkculture		1	-	2	2	Audit Course	-	-	-	G	-	-	-
BMEL206/ BMEL204	Mechanicsof Material/ KinematicsofMachines		3	1	-	4	4	20	20	60	-	-	100	3
BMEL207/ BMEL203	Manufacturing Process-I/ Materials Engineering		3	-	-	3	3	20	20	60	-	-	100	3
BMEP207/ BMEP203	Manufacturing Process-I/ Materials Engineering		-	-	2	2	1	-	-	-	25	-	25	-
BMEGP203/ BMEGP202	General Proficiency-III/ General Proficiency-II	III	-	-	2	2	Audit Course	-	-	-	G	-	-	-
		II	1	-	2	3	Audit Course	-	-	-	G	-	-	-
	Total		**16**	**1**	**12**	**29**	**21**	**100**	**100**	**300**	**75**	**7 5**	**650**	**-**

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GROUP- I& II SEMESTER-III

Sub. Code Group-I	Name of the Course Group-I	Teaching Scheme				Credits	EvaluationScheme							Sub. Code Group-II	Name of the Course Group-II
							Theory			Practical		Total	Duration Of		
		Th	Tu	Pr	Total		TAE (20)	CAE (20)	ESE (60)	Con .Ass	Ext. Oral				
BEML202	Engineering Mathematics-III	3	1	-	4	4	20	20	60	-	-	100	3	BEML202	Engineering Mathematics-III
BMEL201	Machine Drawing	3	-	-	3	3	20	20	60	-	-	100	3	BMEL201	Machine Drawing
BMEP201	Computer Aided Machine Drawing	-	-	2	2	1	-	-	-	25	-	25	-	BMEP201	Computer Aided Machine Drawing
BMEL202	Fluid Mechanics	3	-	-	3	3	20	20	60	-	-	100	3	BMEL202	Fluid Mechanics
BMEP202	Fluid Mechanics			2	2	1	-	-	-	-	25	25	-	BMEP202	Fluid Mechanics
BMEL203	Materials Engineering	3	-	-	3	3	20	20	60	-	-	100	3	BMEL206	Mechanics of Material
BMEP203	Materials Engineering	-	-	2	2	1	-	-	-	25	- -	25	-	BMEL207	Manufacturing Process I
BMEL204	Kinematics of Machines	3	1	-	4	4	20	20	60	-	-	100	3	BMEP207	Manufacturing Process I
BMEL205	Engineering Thermodynamics	3	-	-	3	3	20	20	60	-	-	100		BMEL205	Engineering Thermodynamic
BMEP205	Engineering Thermodynamics	-	-	2	2	1	-	-	-	-	25	25	-	BMEP205	Engineering Thermodynamic
BMEGP202 / BMEGP203	General Proficiency-II/ General Proficiency-III II	1	-	2	3	Audit Course	-	-	-	G	-	-	-	II BMEGP202/ BMEGP203	General Proficiency-II/ General Proficiency-III
	III	-	-	2	2	Audit Course	-	-	-	G	-	-	-	III	
	Total	**18**	**2**	**10**	**30**	**24**	**120**	**120**	**360**	**50**	**50**	**700**	-		

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GROUP-I & II SEMESTER-IV

Sub. Code Group-I	Name of the Course Group-I	Teaching Scheme				Credits	Evaluation Scheme							Sub. Code Group-II	Name of the Course Group-II
							Th			Practical		Total	Duration		
		Th	Tu	Pr	Total		TAE (20)	CAE (20)	ESE (60)	Con Ass	Ext. Oral				
BEML212	Applied Numerical methods & Optimization	3	-	-	3	3	20	20	60	-	-	100	3	BEML212	Applied Numerical methods & Optimization
BEMP212	Applied Numerical methods & Optimization	-	-	2	2	1	-	-	-	25	25	50	-	BEMP212	Applied Numerical methods & Optimization
BMEL208	Mechatronics	3	-	-	3	3	20	20	60	-	-	100	3	BMEL208	Mechatronics
BMEP208	Mechatronics	-	-	2	2	1	-	-	-	25	25	50	-	BMEP208	Mechatronics
BMEL209	Fluid Machinery	4	-	-	4	4	20	20	60	-	-	100	3	BMEL209	Fluid Machinery
BMEP209	Fluid Machinery	-	-	2	2	1	-	-	-	-	25	25	-	BMEP209	Fluid Machinery
BMEP210	Industrial safety practices and work culture	1	-	2	3	Audit Course	-	-	-	G	-	-	-	BMEP210	Industrial safety practices and work
BMEL206	Mechanics of Material	3	1	-	4	4	20	20	60	-	-	100	3	BMEL203	Materials Engineering
BMEL207	Manufacturing Process-I	3	-	-	3	3	20	20	60	-	-	100	3	BMEP203	Materials Engineering
BMEP207	Manufacturing Process-I	-	-	2	2	1	-	-	-	25	-	25	-	BMEL204	Kinematics of Machines
BMEGP203/ BMEGP202	General Proficiency-III/ General Proficiency-II III	-	-	2	2	Audit Course	-	-	-	G	-	-	-	III BME GP202/ BMEGP203	General Proficiency-II/ General Proficiency-III
	General Proficiency-II II	1	-	2	3	Audit Course	-	-	-	G	-	-	-	II	
	Total	**18**	**1**	**12**	**30**	**21**	**100**	**100**	**300**	**75**	**75**	**650**	**-**		

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Department of Mechanical Engineering

Session : 2017-2018 Offer List

SEM-III (Group-I)

Sr No.	Sub Code	Course	Hrs	Credits	Marks
1	BEML202	**EngineeringMathematics-III**	4	4	100
2	BMEL201/ BMEP201	**Machine Drawing**	5	4	125
3	BMEL205/ BMEP205	**Engineering Thermodynamics**	5	4	125
4	BMEL202/ BMEP202	**Fluid mechanics**	5	4	125
5	BMEL203/ BMEP203	Materials Engineering	5	4	125
6	BMEL204	Kinematics of Machines	4	4	100
7	BMEGP202/203	General Proficiency-II/III	3/2	G	-
		Total:	31/32	24	700

SEM-III (Group-II)

Sr No.	Sub Code	Course	Hrs	Credits	Marks
1	BEML202	**Engineering Mathematics-III**	4	4	100
2	BMEL201 /BMEP201	**Machine Drawing**	5	4	125
3	BMEL205 /BMEP205	**Engineering Thermodynamics**	5	4	125
4	BMEL202/ BMEP202	**Fluid mechanics**	5	4	125
5	BMEL207/ BMEP207	Manufacturing Process-I	5	4	125
6	BMEL206	Mechanics of Material	4	4	100
7	BMEGP203/202	General Proficiency-III/II	2/3	G	-
		Total:	31/32	24	700

SEM-IV (Group-I)

Sr No.	Sub Code	Course	Hrs	Credits	Marks
1	BEML212/ BEMP212	**Applied Numerical Methods and Optimization**	5	4	125
2	BMEL208/ BMEP208	**Mechatronics**	5	4	125
3	BMEL209/ BMEP209	**Fluid machinery**	6	5	125
4	BMEP210	**Industrial Safety & Work Culture**	3	G	-
5	BMEL207/ BMEP207	Manufacturing Process-I	5	4	125
6	BMEL206	Mechanics of Material	4	4	100
7	BMEGP203/202	General Proficiency-III/II	2/3	G	-
		Total:	30	21	600

SEM-IV (Group-II)

Sr No.	Sub Code	Course	Hrs	Credits	Marks
1	BEML212/ BEMP212	**Applied Numerical Methods and Optimization**	5	4	125
2	BMEL208/ BMEP208	**Mechatronics**	5	4	125
3	BMEL209/ BMEP209	**Fluid machinery**	6	5	125
4	BMEP210	**Industrial Safety & Work Culture**	3	G	-
5	BMEL203/ BMEP203	Materials Engineering	5	4	125
6	BMEL204	Kinematics of Machines	4	4	100
7	BMEGP202/203	General Proficiency-II/III	3/2	G	-
		Total:	30	21	600

Course Syllabus
SY-B.Tech(Sem-III)

BEML202:ENGINEERING MATHEMATICS-III	
Teaching Scheme: **Lectures:**3 Hrs/Week **Tutorials:** 1 Hr/Week	**Examination Scheme Theory** **Teachers Assessment:**20 Marks **Continuous Assessment:**20 Marks **End Sem Examination:** 60 Marks
Credit:4	
PREREQUISITE(IF ANY):	
1. Applied Mathematics – I,II	
COURSE OBJECTIVE:	
1. To introduce the concepts of Laplace transforms, Fourier series. Partial differential equations, Matrices, Numerical methods and Z Transform.	
2. To explain the physical significance and applications of above mathematical tools in mechanical engineering.	
COURSE OUTCOME :- Student Will	
1. Appraise the complex problems with few assumptions and estimate the reasonableness of solutions.	
2. Compute the physical significance of mathematical descriptions in time domain, frequency domain.	
3. Summarize the mathematical descriptions in Fourier series, differential equations, matrices and complex	
4. Explain the approximations in the solution of ordinary differential equation with Specified degree of accuracy with the help of numerical methods.	
5. Compute mechanical problems involving discontinuous force function or periodic function using Laplace transform.	
6. Explain continuous frequency resolution of a function and study of frequency response of a filter by using Fourier series and Fourier transform.	
COURSE CONTENTS	**Hrs**
UNIT – I : LAPLACE TRANSFORMS	7
Laplace transformer and their simple properties, simple application of Laplace transform to solve ordinary differential equation including simultaneous equations, salutation of one dimensional partial differential equation by transform method.	
UNIT – II: FOURIER SERIES AND SIGNAL SPECTRA	7

Introduction, The fourier theorem, evaluation of Fourier coefficient, consideration of symmetry (odd, even, rotational), exponential form: Fourier series, integral theorem, Fourier transform and continues spectra.	
UNIT – III : PARTIAL DIFFERENTIAL EQUATION	7
Partial Differential Equation of first order and first degree Lagrange's form, linear homogenous equations of higher order with constant coefficients. Method of separation of variable application to transmission lineModeling of vibrating string, Wave equation, one and two dimensional Heat Flow equations.	
UNIT – IV : MATRICES	7
Inverse of matrix by adjoint method and it used in solving simultaneous equation, rank of matrix, consistency of system of equation, inverse of matrix by portioning method, linear dependence, liner and Orthogonal Transformation. Characteristic equation Eigen values and Eigen vectors, Reduction to diagonal form, cayley – Hamilton Theoram (Withought Proof) Statement and verification. Sylfetors thermo, association of matrices with linear differential equation of second order with constant coefficient, determination of largest eigen value and Eigen vactor by iteration method.	
UNIT – V: STATISTICS AND PROBABILITY	7
Measures of Central Tendency , Standard Deviation, Coefficient of Variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression Estimates Theorems and Properties of Probability, random variables, Probability Density Function, Probability Distributions: Binomial, Poisson, normal &hypergeometric, Test of Hypothesis: Chi-Square test.	
UNIT – VI : THE Z- TRANSFORM	7
Z-Transform, invers Z-Transform Relationship of the Fourier transform to Z-Transform, properties of zTransform convolution of two sequence, poles and zeros, the inverse from by partial fraction expension, The inverse Z-Transform by partial properties, solution of difference equations. Advanced topic on the subject.	

Guidelines for Tutorial
1. Tutorial shall be engaged in two batches (batch size of 30-40 students maximum) per division.
2. Tutorial shall consist of 10-12assignments (two per each unit) which are not covered in Lectures.

Text Books:
1. Grewal, B.S, Higher Engineering Mathematics, Thirty Eighth Edition, Khanna Publishers, 2004.
2. Kreyszig, E., Advanced Engineering Mathematics, Eighth Edition, John Wiley & Sons, 2000.
3. Higher Engineering mathematics,B.VRamana

Reference Books :
1. Jain, R.K. and Iyengar,S.R.K, Advanced Engineering Mathematics, Third Edition, NEW DELHI Narosa Publishers, 2007.
2. Higher Engineering Mathematics.Green berg
3. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers,7 th Ed., 2010
4. H. K. Dass and Er. RajnishVerma: "Higher Engineerig Mathematics", S. Chand publishing, 1st edition, 2011.

BMEL201: MACHINE DRAWING

Teaching Scheme: **Lectures:**3Hrs/Week **Tutorials:**Nil	**Examination Scheme (Theory)** **Teachers Assessment:**20 Marks **Continuous Assessment:**20 Marks **End Sem Examination:**60 Marks

Credit :-3

PREREQUISITE(IF ANY):

Engineering Graphics

COURSE OBJECTIVE:

1. To study the basics of engineering drawing in mechanical engineering and applications.
2. To study design data and for selection of standard components.
3. To provide the exposure to the orthographic and sectional views with dimensions .
4. To understand the principles and techniques of assembly drawing.
5. To be able to read production drawing with different geometrical features.

COURSE OUTCOME: Upon successful completion of the course students will be

1. Able to understand the machine drawing
2. Able to understand 3-dimensional object into 2-dimensional and sectional views.
3. Able to use ISI standards and handbook to represent machine components.
4. Able to draw the manufacturing drawing of machine components and mention tolerances on the same
5. Able toproduce part list and process planning sheet.
6. Able to produce machine drawing using CAD tools.

COURSE CONTENTS	**Hrs.**
UNIT I DRAWING STANDARDS	6
BIS Specification-Welding symbols,Machining Symbols, Surface Finish Symbols, Heat Treatment, Manufacturing Instructions, Fits and Tolerance allocation for mating parts- tolerance data sheet - tolerance table preparation - Geometric Tolerance and Allowance. Indicating on the drawing of position, as per standard and as per prevalent in industry	
UNIT II INTERPRETATION OF ORTHOGRAPHIC PROJECTION	6
Orthographic Projections of elements, Sectional Multiple-Missing views, Profiles , Cross Sections, References, Alignment &Dimensioning.	
UNIT III STANDARD PRACTICES AND STUDY FOR FOLLOWING ELEMENTS	6

(EXCLUDING DESIGN CALCULATIONS)	
Reference to Hand Book for selection of Standard Components like – Bolts , Washers, rivets, Welds, Keys and Keyways, Splins, Couplings, Cotter joints, Fabrication Bolts	
UNIT IV ASSEMBLY DRAWING	7
Principles, Techniques, Types and Standards for Preparation of assembled views given parts details - couplings: flange, universal - Bearing: footstep, Plummer block - Lathe tailstock - Stop valves, Screw Jack – etc	
UNIT V PRODUCTION DRAWING	7
Elements of production drawing Information (Plates, Part list, Formats) on: tolerances, manufacturing methods, Production planning Sheet, Process planning Sheet.	
UNIT VI Computer Aided Drawing and Tools	8
Introduction – solid modeling, introduction to Graphical User Interface (GUI) of any commercially used solid modeling software Introduction –Parametric solid modeling – fundamentals apply/modify constraints and dimensions; transform the parametric 2-D sketch into 3D solid, feature operations.	

Text Books: (Book Title, Name of the author, name of the Publisher, edition, year of publication)
1. K L Narayana, P. Kannaih , K. Venkata Reddy, 'Machine Drawing', New Age International (P)Ltd. Publishers, 3rd Edition,2006.
2. Ajeet Singh, 'Machine Drawing', Tata McGraw Hill Education, 2nd Edition, 2012.
3. P. S. Gill "A Textbook of Machine Drawing" 2nd Edition 1998.

Reference Books :
1. R.K.Dhawan, 'A Textbook of Machine Drawing', S Chand & Co Ltd; 2nd Edition, 1998.
2. N. D. Bhatt , 'Machine Drawing, CharotarPublishing House, 26th Edition,1991
3. PSG College of Technology, 'Design Data Book', 1996
4. CMTI , 'Machine Tool Design Handbook', TMH,2012

BMEP201: Computer Aided Machine Drawing	
Teaching Scheme: **Practical:**2 Hrs/Week	**Examination Scheme (Laboratory)** **Continuous Assessment:** 25 Marks **External** :Nil
Credits: 1	**Hrs.**
Pencil Drawing of standard assemblies with components. The students must be made to disassemble machines and take actual dimensions and prepare parts drawings, assembly drawings, exploded views and isometric views as record work. Some Machines of Interest are: Lathe Chuck, Gear Reducer, Gear Pump, Steam Stop Valve, Pneumatic Cylinder assembly, Pneumatic Valves, Centrifugal Pump Assembly, Engine Cylinder-Piston, Connection Rod And Crankshaft Assembly, I.C. Automobile Gear Box. For sheet 5, 6 and 7 use any solid modeling software (Any two is compulsory from 5, 6&7).	
1. Report on Dimensioning, Symbols(Welding, Machining & Surface Finish)	1
2. Sheet 1 : Orthographic Projections & Missing Views, Sectional Views (Manual drawing)	2
3. Sheet 2 : Sketching Of Machine Components, Keys, Cotters & Coupling Joint (Manual drawing)	2
4. Sheet 3 & 4 : Assembling and Disassembling (manual drawing)	4
5. Sheet 5 : Production Drawing & Process Planning Sheets(On CAD Software)	4
6. Sheet 6:2-D sketching with geometrical and dimensional constraints using any commercially used solid modelling software.	4
7. Sheet 7: Parametric solid modelling of a machine component using various commands and features of the software.	4
NOTE: The examination must include:	
1. Total Assembly Test.	
2. Identifying the Missing Element of the Assembly.	
3. CAD modeling test	

BMEL202: Fluid Mechanics	
TeachingScheme: **Lectures:** 3Hrs/Week **Tutorials:** Nil	**Examination Scheme (Theory)** **Teachers Assessment :**20 Marks **Continuous Assessment:** 20 Marks **End Sem Examination :** 60 marks
Credit: 3	
PREREQUISITE(IFANY):	
1. Engineering Mathematics, Engineering Physics	
COURSE OBJECTIVE:	
1. To understand the basic fluid properties like density, specific gravity etc	
2. To understand type of fluid flows, continuity equation, venturimeter, orifice meter	
3. To understand the concept of boundary layer	
4. To understand the momentum equation and its application to various fluid machineries	
5. To study various techniques of dimensional analysis.	
6. To understand the concepts of mass, momentum and energy conservation to flows.	
COURSEOUTCOME: On successful completion of the course, students will be	
1. Able to understand the basic terms and definitions of fluid mechanics.	
2. Should understand the continuity, Eulers and Bernoulli's equations.	
3. Able to demonstrate the working of flow measuring devices.	
4. Able to understand the various losses in pipe flow and also the boundary layer conceptleading to flow separation, drag and lift.	
5. Able to calculate forces on fixed blades, moving blades and velocity diagrams.	
6. Able to understand the concept of dimension less numbers.	
COURSE CONTENTS	**Hrs.**
UNIT–I :PROPERTIES OF FLUIDS	7
Density, Specific gravity, Specific Weight, Specific Volume Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity ,Vapour Pressure, Compressibility Fluid pressure, Pressure head, Pressure intensity Concept of absolute vacuum, gauge pressure, atmospheric Pressure, absolute pressure. Simple and differential manometers, Bourdon pressure gauge. Concept of Total pressure on immersed bodies, center of pressure	
UNIT–II: FLUID FLOW	7

Types of fluid flows, Kinematics of fluid flow, Continuity equation, Euler's and Bernoulli's theorem and equation ,Venturimeter – Construction, principle of working, Coefficient of discharge, Derivation for discharge through venturimeter. Orifice meter – Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter Pitot tube – Construction, Principle of Working ,Current Meter, Turbine Meter, Elbow meter.	
UNIT–III : FLOW THROUGH PIPES	8
Laws of fluid friction (Laminar and turbulent), Darcy's equation and Chezy's equation for frictional losses. Minor losses in pipes Hydraulicgradient and total gradient line. Hydraulic power transmission through pipe, Energy Gradient; Pipe in series and parallel ; Branched pipes; three reservoir system; Syphon; Transmission of power through pipes; Water Hammer pressure due to sudden closure of valve.	
UNIT–IV: BOUNDARY LAYER CONCEPTS:	8
Nominal thickness, Displacement thickness and Momentum thickness .energy of the boundary layer; Boundary layer along a long thin plate and its characteristics; Laminar boundary layer; Turbulent boundary layer; Separation of boundary layer on plane and curved surfaces. Drag & Lift: Definition of drag and lift; Flow past plates, Cylinders and sphere; Drag on sphere, cylinder and flat plate.	
UNIT–V :MOMENTUM PRINCIPLE AND ITS APPLICATION	5
Impulse- momentum principle, Calculation of force exerted on fixed plate, moving flat plates& curved vanes, Calculation force exerted on series of moving vanes, velocity diagrams & their analysis.	
UNIT–VI: DIMENSIONAL ANALYSIS:	5
Fundamental dimensions, dimensional Homogeneity, Rayleigh's method and Buckingham's' method. Dimension less numbers and their significance. Hydraulic similitudes, Type of models, Problems related to Reynolds number & Froude number.	

Textbooks:
1. LalJagdish, 'Hydraulic machines', Metropolitan Book Co.Pvt. Ltd., 6th edition 1984
2. D.S. Kumar, 'Fluid Mechanics and Fluid Machines', S. K. Kataria& Sons, 4th edition 1992
ReferenceBooks:
1. Bansal R.K., 'Fluid Mechanics and Fluid Machines', Laxmi Publications,7th edition 2002
2. Massey B.S., 'Mechanics of Fluids', Van Nostrand Reinhold Co., 6th edition 1989
3. R.K.Rajput, 'A Text book of Fluid Mechanics and Hydraulic Machines', S.Chand Co.Ltd.,2002.
4. Modi&Seth,'Fluid Mechanics & Fluid Machinery',Standard Book House 2002.

BMEP202: Fluid Mechanics	
TeachingScheme: **Practical:** 2 Hr/Week	**Examination Scheme(Laboratory)** **Continuous Assessment:**NIL **External**: 25 Marks
Credits: 1	

List of Practical's (Perform any 8 experiments)	Hrs
1. Pressure measurement using any two types of manometer.	2
2. Determination of viscosity of liquids and its variation with temperature.	2
3. Determination of metacentric height of floating object.	2
4. Laminar and Turbulent flow by Reynolds's apparatus.	2
5. Draw flow net using electrical analogy apparatus.	2
6. Verification of modified Bernoulli's equation.	2
7. Determination of hydraulic coefficients of Orifice meter/ Venturimeter	2
8. Calibration of V-notch	2
9. Determination of minor losses due to pipe fittings.	2
10. Determination of Major losses through metal & non-metal pipes.	2

BMEL203: MATERIALS ENGINEERING

Teaching Scheme:	**Examination Scheme (Theory)**
Lectures: 3Hrs/Week	**Teachers Assessment: 20Marks**
Tutorials: Nil	**Continuous Assessment : 20Marks**
	End Sem Examination: 60 Marks

Credit: 3

COURSE OBJECTIVE:

1. To introduce various materials used in manufacturing metallic.
2. To introduce & correlate between science and Engineering of metallic materials.
3. To introduce the quantitative measurement of material properties.
4. To introduce various techniques for enhancing the inherent characteristics of materials.

COURSE OUTCOME: On successful completion of the course, students will have capabilities like,

1. Acquire basic knowledge related to the metallic materials especially steels and cast iron.
2. Summarize the process of co-relation of science behind the properties of the materials will get initiated.
3. Evaluate the new concepts of observation of microstructure of metallic materials.
4. Predict the various types of steels used and microstructure of the materials.
5. Explain the fundamentals of heat treatment process and their impact on materials.
6. Distinguish various mechanical testing methods and its applications.

COURSE CONTENTS	**Hrs.**
UNIT – I : CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS	8
Introduction to Basic Terms (System, Phase, Variables, and Components Etc.) related to equilibrium diagram. Alloys and solid solutions, compounds. Polymorphism, HumeRuther rules Time Temperature cooling curves, Construction of equilibrium diagrams using cooling curves, Binary phase diagrams Iso amorphous, Metallic systems completely miscible in liquid state and completely immiscible in solid-state Lever rule, equilibrium cooling, Microstructures under equilibrium cooling conditions, Eutectic, Hyper and hypoeutectic alloys and their applications.	
UNIT – II : FERROUS MATERIALS	8

Plain Carbon Steel and Alloy Steels a)Allotropy of Iron, Iron –Iron carbide equilibrium diagram, Invariantreactionsmicrostructure under equilibrium cooling condition, b) Purpose of alloying, Different alloying elements and their effect on enhancing thedifferentcharacteristics, Tool steels, Stainless steel,springsteel, designation. C)Cast iron, White cast iron, Maurer Diagram, malleable cast iron, malleablizing cycle, Greycast iron, Types of grey cast iron, Nodular cast iron., Alloy cast iron. Microstructure, properties and application of every cast iron	
UNIT – III: Study of Plastics and Composites	7
Introduction & Classification of Materials, Definition, Classification & characteristics of polymers, Types of polymerization, Polymer processing, Elastomers, properties and applications of engineering polymers. Properties, processing and applications of ceramic materials (WC, TIC, Al2O3), Cermets. Composite materials, Classification & Types of composite, Properties & applications, Metal matrix composite, Ceramic matrix composite, Fiber Reinforced plastic , b) Introduction to Plastics, Types, Applications.Numerical based on composite (isostress&isostrain conditions).	
UNIT – IV: Heat Treatment	
a) Introduction, importance of heat treatment, Basic heat treatments such as annealing,normalizing, hardening and tempering, procedure, allied phases - martensite, retainedausteniteetc related properties, and microstructure and their co-relation.TTT diagram, construction, heat treatment based on it. Industrial application of different heat treatment process, jominy end quench test.b) Surface Treatments based on above such as Induction hardening.	7
UNIT –V: NON-FERROUS MATERIALS AND NEW GENERATION MATERIALS	6
Brief introduction to different nonferrous materials and study of the Aluminum and itsalloy, eg. Aluminium Silicon, related phase diagram, Na modification Copper and its alloys. Introductiontonano materials, Smart materials,high temperature smart materials, properties and relevant applications.	
UNIT –VI: TESTING OF MATERIALS	6
Need of testing,Destructive and nondestructive testing Mechanical testing, Tensile test,Impact test Izod and Charpy test Hardness measurement, Rockwell , Brinellhardness,micro hardness. Magnetic particle inspection and applications of hardness testing. Advanced testing Methods.	

Text Books: (Book Title, Name of the author, name of the Publisher, edition, year of publication)
1. Introduction to Physical Metallurgy by S. H. Avener McGraw Hill Publication,,2001
2. Engineering Physical Metallurgy & Heat Treatment, Lakhtin Y.; 6th Ed; Mir Publishers, 1998
3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill.
Reference Books:
1. Metallurgy forEngineers,RollasonE.C.;Edward Arnold publications.
2. Introductionto Engineering Metallurgy,Grewal B.K
3. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.
4. V.Raghavan, Materials Science and Engineering, , PHI, 2002

BMEP203: Materials Engineering	
Teaching Scheme: **Practical:** 2 Hrs/Week	**Examination Scheme (Laboratory)** **Continuous Assessment :** 25 Marks **External: Nil**
Credits: 1	
List of Practical's: Perform any eight	**Hrs**
1. A) Study & Demonstration of Specimen Preparation for microscopic examination. B) Study of Optical Metallurgical microscope. C) Study and Drawing of Microstructure of Steels of various compositions.	2
2. A) Study and Drawing of Microstructure of Cast Irons B) Study and Drawing of Microstructure of Non Ferrous Metals.	2
3. Heat treatment of Plain Carbon Steel and determination of relative hardness.	2
4. Study and Drawing of Microstructure of Heat Affected Zone in Welding.	2
5. Jominy End Quench Test for hardenability.	2
6. Impact Test.	2
7. Vickers Hardness Test.	2
8. Brinell&Poldi Hardness Test.	2

9. Magnetic Particle & Dye Penetrant Test.	2
10. Stress-strain diagram for Ductile and Brittle specimen under tensile test.	2
11. **Open Ended Experiment:**Torsional Testing of circular shafts	2
Note: Out of above 12, any 8 Practical's should be conducted.Out of above, experiment number 1,2,5,6,8 are compulsory.	

BMEL204: KINEMATICS OF MACHINES

Teaching Scheme:	**Examination Scheme Theory**
Lectures:3 Hrs/Week	**Teachers Assessment:**20 Marks
Tutorials: 1 Hr/Week	**Continuous Assessment:20 Marks**
	End Sem Examination: 60 Marks

Credit: 4

PREREQUISITE(IF ANY):

1.Basics of Mechanical Engineering, Engineering Mechanics

COURSE OBJECTIVE:

1. To understand basic concepts of different mechanisms and its applications to various fields.
2. To develop competency in graphical and analytical methods in solving problems of quantitative Kinematic analysis of mechanism.
3. To make students conversant with Concepts of cam mechanism
4. To make the students conversant with basic concepts of gears, its applications and torque analysis
5. To develop analytical competency in designing efficiency of various gears
6. To make the students conversant with static force analysis and synthesis of mechanism.

COURSE OUTCOME : On successful completion of the course, students will be

1. Able to understand concept of mechanism and its terms/definitions.
2. Able to draw velocity & acceleration diagram with analytical skills
3. Able to demonstrate cam follower mechanisms.
4. Able to understand concept of motion by various gears.
5. Able to analyze forces acting on various linkages and bodies.

COURSE CONTENTS	**Hrs.**
Unit I Introduction to Mechanism	7
Basic concept of mechanism, link, kinematic pairs, kinematic chain, mechanism, machine, simple and compound chain, Degree of freedom, estimation of degree of freedom of mechanism by Grubbler's criterion and other methods. Harding's notations, classification of four bar chain [class – I & class – II], inversion of four–bar–chain, Kutchbach theory of multiple drives.	
Unit II Velocity and Acceleration analysis	7

Quantitative kinematic analysis of mechanism :- Displacement, Velocity and Acceleration analysis of planer mechanism by graphical method as well as analytical method [complex number method / matrix method']Coriolis component of acceleration, Instantaneous center method, Kennedy's theorem	
Unit III Cam & Follower	7
Concepts of cam mechanism, comparison of cam mechanism with linkages. Types of cams and followers and applications. Synthesis of cam for different types of follower motion like constant velocity, parabolic, SHM, cycloidal etc. Pressure angle in cam, parameters affecting cam performance.	
Unit IV Spur Gear	7
Concept of motion transmission by toothed wheels, comparison with cams and linkages, various tooth profiles, their advantages and limitations, gear tooth terminologies, concept of conjugate action, law of conjugate action, kinematics of involutes gear tooth pairs during the contact duration, highlighting locus of the point of contact, arc of contact, numbers of pairs of teeth in contact, path of approach and path of recess, interference, undercutting for involutes profile teeth	
Unit V Helical ,Bevel & Worm gear	7
Kinematics of helical, bevel, spiral, worm gears, rack and pinion gears, kinematic analysis, and torque analysis of simple Epicyclic and double Epicyclic gear trains, (Numerical)	
Unit VI Static force analysis	7
Static force Analysis: Free body diagram, condition of equilibrium. Analysis of all links of given linkage, cam, gear mechanism and their combinations without friction. Introduction to coupler curves, Robert's Law of cognate linkages. Synthesis of four bar chain for gross motion, transmission angle optimization. Frudenstein equation and its application for function generation.	

Kinematics of Machines Tutorials:

Tutorials to be submitted in the form of Journal: (Study any Five of the following)	Hrs.
1. Draw (any 4) configurations of mechanisms and determine types of pairs, links, degree of freedom.	2
2. Two problems on velocity and acceleration analysis using relative velocity and acceleration method.	2
3. Two problems on velocity and acceleration analysis using relative velocity and acceleration method involving Coriolis component.	2
4. To draw the cam profiles and study the effect of a. Different follower motions. b. Different follower (roller) dimensions	2

5. To study various types of gearboxes- constant mesh, sliding mesh, synchromesh gear box, Industrial gearbox, differential gearbox.	2
6. Kinematic analysis of transmission system of any machine such as automobile/ machine tool	2

Text Books: (Book Title, Name of the author, name of the Publisher, edition, year of publication)
1. "Theory of Machines", Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2 nd edition -2005.
2. "Theory of Machines", Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2 ND Edi. 2006.
3. J.S. Rao&Dukki Patti, 'Mechanism and Machine Theory'
Reference Books:
1. "Theory of Machines & Mechanisms" ,Shigley. J. V. and Uickers, J.J., OXFORD University press.2004
2. "Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004.
3. Ghosh and Malik, 'Theory of Mechanism and Machine'
4. Theory of Machines and Mechanism by John Uiker, Garden Pennock& Late. J. F. shigley

BMEL205: ENGINEERING THERMODYNAMICS	
Teaching Scheme: **Lectures:** 3Hrs/Week **Tutorials:** Nil	**Examination Scheme(Theory)** **Teachers Assessment:** 20Marks **Continuous Assessment:** 20Marks **End Sem Examination:**60Marks
Credit: 3	
PREREQUISITE(IFANY):	
1. Engineering Mathematics	
2. Engineering Physics/chemistry	
3. Basic Mechanical Engineering	
COURSE OBJECTIVE:	
1. Identify the unique vocabulary associated with thermodynamics through the precise definition of Basic concepts	
2. To form a sound foundation for the development of the scientific principles	
3. Review the English and the metric SI Unit systems that will be used throughout the text	
4. Explain the basic concepts of thermodynamics such as system, state, state postulate, equilibrium, Process, cycle, energy, and various forms of energy such as system, state, state postulate, equilibrium, process, cycle, energy, and various forms of energy	
5. Review concepts of temperature, temperature scales, pressure, and absolute and gage pressure	
6. Introducing basics of ideal and real gases, steam formation, basic laws of thermodynamics and their properties.	
7. Introduce an intuitive systematic problem- solving technique that can be used as a model in solving engineering problem	
COURSE OUTCOME: On successful completion of the course, students will be	
1. Able to understand Gas laws and various terms/definitions of thermodynamics.	
2. Able to understand 1st and 2nd law of thermodynamics and their applications.	
3. Able to understand concept of heat engine/refrigerator/heat pump.	
4. Able to analyze gas power cycles and processes.	
5. Able to understand the Rankine cycle modified Rankine cycle used in thermodynamics.	
COURSECONTENTS	**Hrs**
UnitI BASIC CONCEPTS AND PROPERTIES	6
Introduction, thermodynamic system, control volume, macroscopic and microscopic approaches, properties and state of a system, point and path functions, thermodynamic equilibrium, processes and cycles, quasi-static process, properties such as specific volume, pressure, temperature, zeroth law of thermodynamics, temperature scales	

UnitII:IDEAL GASES AND VAPORS	7
Difference between gases and vapors, ideal gases, gas laws, equation of state, gas constant, universal gas constant, work and heat, definition of work, thermodynamic work, work in compressible system, work-a path function, work done during various processes, p-diagram, definition of heat, heat transfer a path function, comparison of heat and work, Phase change process of a pure substance: specific heats, sensible heat and latent heat, triple point, critical point, superheat and total heat of steam	
Unit III:FIRST LAW OF THERMODYNAMICS	8
Energy of systems, classification of energy, law of conservation of energy, first law applied to closed system undergoing a cycle, Joule experiment, energy-a property of system, internal energy: a function of temperature, enthalpy, specific heat at constant volume and constant pressure, change in internal energy and heat transfer During various non-flow processes. First law applied to flow processes: steady-state steady flow process, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and Diffusers, throttling valve, turbines and compressors, pumps, heat exchangers etc. Work done and heat transfer during steady flow processes.	
UnitIV:SECOND LAW OF THERMODYNAMICS	8
Limitations of first law, heat engines, refrigerators and heat pumps, Kelvin-plank and Clausius statements, their equivalence, reversible and irreversible processes, factors that render Processes irreversible, Carnot cycle, perpetual motion machine. Thermodynamic scale, reversed Carnot cycle, COP of heat pump and refrigeration. Entropy: Inequality ofClauses, entropy: a property of system, entropy change for ideal gases, entropy change of a system during irreversible process, lost work, principle of increase of entropy	
UnitV:THERMODYNAMIC PROCESSES AND POWER CYCLES	7
Thermodynamic processes: Constant volume, isothermal, adiabatic, polytrophic Processes, throttling and free expansion- p-v and T-s diagrams-work done, heat exchanged, change in internal energy, Availability and irreversibility. Gas power cycles: Otto cycle, Diesel cycle, semi-Diesel, Sterling cycles, their efficiency and mean effective pressure calculations, Dual cycle, Ericsson cycle	
UnitVI:VAPORS POWER CYCLES	6

Properties of steam, specific volume and entropy of steam, dryness fraction of steam, throttling of steam, determination of dryness fraction, steam tables and their use, T-s and H-s diagram, Rankine and modified Rankine cycle, work done and efficiency, specific steam consumption, comparison of Rankine and Carnot cycle, representation on P-v, T-s and h-s diagram	

Text books
1. R.K Rajput, Engineering Thermodynamics, EVVS Thermo Laxmi Publication
2. P.K. Nag, Engineering Thermodynamics, Tata McGraw Hill Publicatio
3. Y V C Rao, "Chemical Engineering Thermodynamics, Universities press 1997
Reference books
1. Y. Cengel&Boles: Thermodynamics-An Engineering approach
2. P.L Ballany : Thermal Engineering ,Khanna Publishers
3. C.P Arora: Engineering Thermodynamics, Tata Mcgraw Hill
4. S. Domkundwar, C.P Kothandaraman, And Domkundwar, Thermal Eng. Dhanpatrai

BMEP205: Engineering Thermodynamics	
Teaching Scheme: **Practical:** 2Hrs/week	**Examination Scheme (Laboratory)** **Continuous Assessment:** Nil **External** : 25 marks
Credits:1	
List of Practical's: Any six experiments of the following and two assignments.	**Hrs.**
1. Joule's experiment	2
2. Trial on steam calorimeter	2
3. Trial on Bomb calorimeter	2
4. Cloud and Pour point of Lubricant	2
5. Flash and Fire point	2
6. Trial on Redwood Viscometer	2
7. Gas calorimeter	2
8. Test on carbon residue	2
9.Open ended Experiments: Write an application/experimental procedure to analyses/demonstrate thermodynamic concept/process/laws Of Thermodynamics	2

BMEGP202: GENERAL PROFICIENCY II- Foreign Language		
TeachingScheme: Lectures: 1Hr/Week **Tutorials:** NIL **Practical:** 2Hrs/Week		**ExaminationScheme(Theory)** **TeachersAssessment:** NIL **Continuous Assessment:** NIL **EndSem Examination:** NIL
Credit	_	-
Audit course	**G**	

PREREQUISITE(IFANY):

NIL

COURSE OBJECTIVE:

1. To learn foreign languages to improve interpersonal skills.
2. To enable improving business communications and having access to literature in globally recognized languages.
3. To help communicate at international forums and explore opportunities for employment

COURSE OUTCOME: On successful completion of the course, students will capability

1. Associate effectively in more than one globally recognized language like French, Spanish, German, Japanese, etc.
2. Demonstrate comprehension of the spoken foreign language in a variety of listening situations.
3. Read and write the foreign language alphabets, their pronunciation techniques, numbers etc.
4. Offer insights into the culture and society of countries where the language is spoken
5. Understand the family and relations, Days, weeks, months, weather, etc.
6. Understand and speak in foreign language like ordering eatables in restaurant, vocabulary of food items, etc.

Topic	Learning Goals	Activities	Hrs
The Alphabets and accents	Pronunciations techniques	Worksheet and charts	1
Number 1 to 20			1
Salutations	Articles , Personal Pronoun	Day timing , Daily routines forms of respects , Vocabulary	1
Family and relations	Shapes and colors , Possessive Pronouns , Gender , Negative Sentence	Relations, Day of Week	1

Weather and Seasons	Climate , Fabrics & Clothes , sizes , interrogatives , Basic verbs	Group Activities , Paragraph writing including , Names of months , Seasons , Sky , Stars	1
House & Household things	Describing neighborhood. Present Tense	Furniture , Household articles, Colors	1
supermarket	Learning the shopping etiquettes , vocabulary of food items , conversing with shopkeepers etc	Project on vocabulary of vegetables and fruits , Bakery products , Group Activity / Role play	1
Timing , Telephonic Conversions	How to Ask time , converse on telephone	Timing and clock (Hours & Minutes)	1
Prominent places and Park	Nature, Directions, Means of transportations, Tenses contd.	Self-introductions , Role-play , preparing Charts	1
In Restaurant / Hotel	Ordering eatables , Table manner ,Verbs	Enhancing vocabulary of food Dishes , Cutlery	1
Visit to Doctor	Health matters, illness. Commonly used verbs contd.	Worksheets , projects	1
French / German /Spanish culture – monuments , delicacies , wines visa vis Indian culture Diwali festival	Vocabulary of clothes Accessories , Cuisines , Beverages , Adjectives	Presentations by students , situation based conversations	1
Receiving Guests/ Entertaining people / Good Bye“s	Customs , Traditions , Manners , welcome &Audieu“s	Activities , Role play , Assignments	1

Course Syllabus
SY-B.Tech(Sem-IV)

BEML212 : Applied Numerical Methods and Optimization

Teaching Scheme:	**Examination Scheme (Theory)**
Lectures: 3Hrs/Week	**Teachers Assessment:** 20 Marks
Tutorials : Nil	**Continuous Assessment:** 30 Marks
	End Sem Examination: 50Marks

Credit: 3

Prerequisite (If any):

1. Engineering Mathematics-I
2. Engineering Mathematics-II
3. Engineering Mathematics-III

Course Objective:

1. Recognize the difference between analytical and Numerical Methods.
2. Effectively use Numerical Techniques for solving complex Mechanical engineering Problems.
3. Prepare base for understanding engineering analysis software.
4. Develop logical sequencing for solution procedure and skills in soft computing.
5. Optimize the solution for different real life problems with available constraints.
6. Build the foundation for engineering research.

Course Outcome: Students will be

1. Able to use appropriate Numerical Methods to solve complex mechanical engineering problems.
2. Able to formulate algorithms and programming.
3. Able to use Mathematical Solver.
4. Able to generate Solutions for real life problem using optimization techniques.
5. Able to analyze the research problem
6. Able to summarize ordinary Differential Equations and Partial Differential Equations and how to apply them to engineering problems.

Course Contents	**Hrs**
Unit – I : ERRORS AND APPROXIMATIONS	8
Types of Errors: Absolute, Relative, Algorithmic, Truncation, Round off Error, Error Propagation, Concept of convergence-relevance to numerical methods. **Roots of Equation** Bisection Method, False position Method, Newton Raphson method and Successive approximation method	
Unit – II : **SIMULTANEOUS EQUATIONS**	8
Gauss Elimination Method, Partial pivoting, Gauss-Seidal method and Thomas algorithm for	

Tridiagonal Matrix	
Unit – III : **OPTIMIZATION**	8
Introduction to optimization, Classification, Constrained optimization: Graphical and Simplex method. One Dimensional unconstrained optimization: Newton"s Method. Modern Optimization Techniques: Genetic Algorithm (GA), Simulated Annealing (SA).	
Unit – IV : **CURVE FITTING & INTERPOLATION**	8
Curve Fitting Least square technique- Straight line, Power equation, Exponential equation and Quadratic equation. **Interpolation** Lagrange„s Interpolation, Newton„s Forward interpolation, Hermit Interpolation, inverse interpolation.	
Unit – V : **NUMERICAL INTEGRATION**	8
Trapezoidal rule, Simpson"s Rule (1/3rd and 3/8th), Gauss Quadrature 2 point and 3 point method. Double Integration: Trapezoidal rule	
Unit – VI :**Calculus of variation**	8
Ordinary Differential Equations [ODE] Taylor series method, Euler Method, Modified Euler Method(Iterative), RungeKuttafourthorderMethod, Simultaneous equations using RungeKutta2nd order method. **Partial Differential Equations [PDE]: Finite Difference methods** Introduction to finite difference method, PDEs- Parabolic explicit solution, Ellipticexplicit solution	

Text Books: (Book Title, Name of the author, name of the Publisher, edition, year of publication)
1.Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley and sons, inc.
2. "Higher Engineering Mathematics", B V Ramana, Tata McGraw-Hill, 2007.
3. "Advanced Engineering Mathematics", R.K. Jain, S.R.K. Iyengar, Narosa Publications.
Reference Books:
1. Michael D. Greenberg; Advanced Engineering Mathematics; Pearson Education Asia
2. Dr.B.S.Grewal; Higher Engineering Mathematics; Khanna publication ,Delhi
3. Peter V. O'Neil; Advanced Engineering Mathematics; 5th edition, Thomson Brooks/Cole.
4. Mathematical Methods in science and Engineering, A Datta

BEMP212: Applied Numerical Methodsand Optimization	
Teaching Scheme: **Practical : 2Hr/Week**	**Examination Scheme (Laboratory)** **Continuous Assessment:** 25 Marks **External :** 25 Marks
Credit: 1	
List of Practical's:	**Hrs**
1. Program on Roots of Equation (Validation by suitable solver, all four compulsory) a). Bisection Method, b. False position Method, c). Newton Raphson method d. Successive approximation method	2
2. Program on Simultaneous Equations (Validation by suitable solver, all three compulsory) a) Gauss Elimination Method, b) Thomas algorithm for tridiagonal matrix, c) Gauss-Seidal method.	2
3. Program on Numerical Integration(Validation by suitable solver, all four compulsory) a) Trapezoidal rule, b) Simpson"s Rules (1/3rd, 3/8th) [In one program only] c) Gauss Quadrature Method- 2 point, 3 point. [In one program only] d) Double integration: Trapezoidal rule, Simpson"s 1/3rdRule.	2
4. Program on Curve Fitting using Least square technique (Validation by suitable solver) a) Straight line, b) Power equation c) Exponential equation d) Quadratic equation	2
5. Program on Interpolation(Validation by suitable solver, all three compulsory) a) Lagrange„s Interpolation, b) Newton„s Forward interpolation, c) Inverse interpolation	2
6. Program on ODE(Validation by suitable solver, all three compulsory) a) Euler Method(Iterative), b) Runge-Kutta Methods- fourth order and Simultaneous equations.(Runge-Kutta 2nd order)	2
7. Program on PDE(Validation by suitable solver)	2
8. Open Ended Practical: Theory assignment on Modern Optimization techniques	2

BMEL206: MECHANICS OF MATERIAL

Teaching scheme:	**Examination Scheme (Theory)**
Lectures: 3Hrs/week	**Teachers Assessment:** 20 Marks
Tutorial: 1Hr/week	**Continuous Assessment** 20 Marks
	End Sem Examination: 60 Marks

Credit: 4

PREREQUISITE (IF ANY):

1. Basics of Mechanical Engineering

COURSE OBJECTIVE:

1. To teach the fundamentals of simple stresses and strains.
2. To enhance skills in Principal stresses and strains.
3. To imbibe the concepts of shear force and bending moment with practical exposure and with applications.
4. To facilitate the concept of bending and its theoretical analysis
5. To learn torsion of shaft
6. To study strain energy and impact loading conditions for various applications.

COURSE OUTCOME: On successful completion of the course, students will

1. Able to understand the basic terms and definitions of Mechanics of Materials.
2. Illustrate SFD and BMD of a beam and determine the maximum moment/shear and their locations.
3. Able to measure deflections of a beam under loads by various methods.
4. Able toPredict and interpret how to calculate stresses and deformation of a torsion bar.
5. Understand the concept of Strain Energy.
6. Able to apply Theories of Failure for practical applications.

Course Content	**Hrs.**
UNIT – I Stresses and Strains	**7**
Concept of simple stresses and strains: Introduction, stress, strain, types of stresses, stress – strain diagram for brittle and ductile material, elastic limit, Hooks law, modulus of elasticity. Modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, thermal stress and strain, thermal stresses with heat flow in cylinders and plates, Hertz's contact stresses Longitudinal strain and stress, lateral stresses and strains, Poisson's ration, volumetric stresses and strain with uni-axial, bi-axial and tri-axial loading, bulk modulus, relation between Young's modulus and modulus or rigidity, Poisson's ratio and bulk modulus. **Principal stresses and strains** :- Definition of principal planes and principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plan in mutually perpendicular two planes, when member is subjected to	

shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of stresses. Derivation of maximum and minimum principal stresses and maximum shear stresses when the member is subjected to combined stress)	
UNIT – II: SFD and BMD	**8**
Shear force and bending moment: Types of beam (cantilever beam, simply supported beam, overhung beam etc.). Types of loads (Concentrated and UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to couple, Relation between load, shear force and bending moment. Stresses in beams: Pure bending, theory of simple bending with assumptions and expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections. Shear stresses in beams: Concept, derivation of share stress distribution formula, stress distribution diagram for common symmetrical sections, maximum and average shear stress.	
UNIT – III :Slope and Deflection	**7**
Deflection of beams: Derivation of differential equation of elastic curve with the assumptions made in it. Deflection and slope of cantilever, simply supported, overhung beams subjected to concentrated load UDL, Relation between slope, deflection and radius curvature Macaulay's method, area moment method to determine deflection of beam.	
UNIT – IV Torsion, Column and Strut	**7**
Torsion of circular shafts: Derivation of torsion equation with the assumptions made int. Torsion shear stress induced in the shaft, when it is subjected to torque. Strength and rigidity criteria. For design of shaft. Torque transmitted by solid and hollow circular shaft. Derivation of maximum, minimum principal stresses and maximum shear stress induced in shaft when it is subjected to bending moment, torque and axial load. Column and Struts: Failure of long and short column, slenderness ration, assumptions made in Euler's column theory, end conditions for column. Expression for crippling load for various end conditions if column. Effective length of column, limitations of Euler's formula, Rankine formula, Johnson's parabolic formula.	
UNIT – V Strain Energy	**5**
Strain energy and impact loading: Definition of strain energy stored in a body when it is subjected to gradually applied load, suddenly applied loads and impact loads. Strain energy stored in bending and torsion. Castingliano's theorem.	
UNIT – VI Theories of failure	**6**
Factor of safety, Statistical methods in determining factor of safety. Theories of failure, modes	

of failure, compound stresses, eccentric axial loading, variable stresses in machine parts, stress concentration and stress raisers, notch sensitivity, stress concentration factor, methods for reducing stress concentration. Goodmans criteria, Soderberg criteria, Gerber's criteria, fatigue design for finite and infinite life of the parts subjected to variable loads.	

Mechanics of Materials- Tutorials:	
Tutorials to be submitted in the form of Journal: (Study any Four of the following)	Hrs
1. Tension test for given material on Universal Testing Machine.	1
2. Compression test for given material on Universal Testing Machine.	1
3. Shear test of ductile material on Universal Testing Machine.	1
4. Experimental verification of flexural formula in bending for simply supported beam.	1
5. Measurement of stresses and strains in beams for different end conditions using strain gauges.	1
6. Experimental verification of torsion formula for circular bar.	1
Assignments	
1. Shear force and bending moment diagram	
2. Shear and bending stresses	
3. Principal stresses and strains	
4. Theories of failure	

Text Books: (Book Title, Name of the author, name of the Publisher, edition, year of publication)
1. Strength of materials, S. Timoshenko and Young - CBS Publications
2. Strength of materials, R. K. Bansal - Laxmi Publications Ltd, New Delhi
3. S Ramamrutham, "Strength of Materials' ,DhanpatRai Publication
Reference Books:
1. R. K. Rajput, 'Strength of material ",S. Chand Publications
2. F.L. Singer, 'Strength of Materials'
3. Strength of Material, S. S. Rattan – Tata McGraw Hill Pub. Ltd.
4. L.S. Srinath, 'Advanced Strength of Materials'- Tata McGraw Hill Pub. Ltd.

BMEL207: Manufacturing Process-I

Teaching Scheme:	**Examination Scheme (Theory)**
Lectures: 3 Hrs/Week	**Teachers Assessment:**20 Marks
Tutorials: Nil	**Continuous Assessment:**20 Marks
	End Sem Examination: 60 Marks

Credit :- 3

PREREQUISITE(IF ANY):

Engineering Graphics

COURSE OBJECTIVE:

1. To select appropriate manufacturing process for producing part under consideration.
2. To identify various process parameter and their effects on processes
3. To analyse and understand the metal cutting phenomenon
4. To select process parameter and tools for obtaining desired machining characteristic
5. To understand design of manufacturing processes.
6. To provide details of manufacturing operations for gears and super finishing processes

COURSE OUTCOME: On successful completion of the course, students will

1. Able to understand machining parameters and operation on Lathe machine
2. Understand the manufacturing processes which they have learned to manufacture new product
3. Understand the principles of foundry and casting.
4. Able to design dies for forging, extrusion, drawing process.
5. Able to understand the welding processes followed in industries
6. Able to understand principles of super finishing processes and selection of grinding wheel.

COURSE CONTENTS	**Hrs.**
UNIT – I :Introduction to Machining Parameters and Lathe Machine :	7
a) Machining Parameters : Introduction to machining, properties nomenclature and tools geometry of single point cutting tool, classification, HSS, carbide tool, coated tools, diamond coated tool, coolant materials. Multi Point cutting tool, Advanced cutting tools. b) Lathe :Introduction, type, construction of simple lathe, mechanism and attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations such as facing, step turning, taper turning, threading, knurling, Numericals on machining time.	

UNIT – II: Drilling and Broaching Machine	7
a) Drilling : Introduction, tools for drilling, classification of drills, twist drills, drill size and specifications, carbide tipped drills, type of drilling machines – portable drilling machine, bench drilling machine, upright drilling machine, radial drilling machine, universal drilling machine, multi- spindle drilling machine, Drilling machines operations, time estimation for drilling. Reaming: Introduction, description of reamers, type of reaming operations. Boring: Introduction, types of boring machine, horizontal boring machine, vertical boring machine, jig boring machine, micro boring, boring operations. b) Broaching: Introduction, type of broaches, nomenclature of broaches and type of broaching machines	
UNIT – III : Casting Process:	7
Casting Process: Introduction, Pattern Making: Types, material used, pattern making allowances, colour code core making: types, core material & its properties. Recent development in pattern making Moulding: types of sand mould, mouldings and composition, moulding sand properties, moulding machines Gating Design: elements of gating system, pouring time, riser design, melting furnace types, electric furnace, induction furnace, cupola- construction & operation, cleaning, inspection and casting defects. Recent trends in melting. Foundry mechanism: special casting processes such as Investment casting, centrifugal casting, shell moulding, Co- moulding, slush casting, Die casting. Automation in foundry operations.	
UNIT – IV :Metal Forming Processes	7
Hot and Cold Working – Concepts and comparative study , friction and lubrication in metal forming Rolling – Types of rolling mills, power required per roll for simple single pass two rollers. (Simple Numerical). Forging – Types, process parameter, Analysis of open die forging (Numerical) Extrusion – Types, process parameter, Extrusion dies, Drawing – Wire drawing and its analysis (Numerical). Sheet Metal Working: Types of sheet metal operations, Types of dies and punches, Die design for Progressive and Drawing Die, clearance analysis, blank size determination (Numerical).	
UNIT – V: Welding and Joining Process	7
Joining Process: introduction to welding, soldering, Brazing processes. Types of welding: Arc welding, MIG, SMAW, GTAW, FCAW, Submerged arc welding, Stud welding. Resistance welding – Theory, Spot, seam and projection weld process & Gas welding processes, defects in various joints and their remedies & inspection of welding joints, electrodes, weld ability of	

metals,weldingequipments of fixtures.	
UNIT – VI : Grinding and Super finishing process:	7
a) Grinding :Grinding operations, grinding wheel, specifications and selection, cylindrical and Centre less grinding operation, surface grinding, tool and cutter grinding. b) Super Finishing Process: Honing, Lapping, polishing, buffing, metal spraying, galvanizing and electroplating. Process parameters and attainable grades of surface finish, surface roughness measurement.	

Text Books:
1. P. N. Rao, "Manufacturing Technology – Foundry, Forming, Welding", Tata McGraw Hill Publishing Co. Ltd.,New Delhi, 2nd Edition, 1998
2. A. Ghosh and A. K. Malik, "Manufacturing Science", Affiliated East West press Pvt. Ltd., New Delhi, 1985
3. S. K. HajraChoudhary, "Elements of Workshop Technology – Vol. I & II Machine Tools", Media Promoters and Publishers Pvt. Ltd., Mumbai, 12th edition, 2007
Reference Books:
1. Manufacturing Engineering and Technology – S. Kalpakjian and SR Schmid
2. Technology of machine Tools – Krar and Oswald
3. Manufacturing Processes – M Begman
4. Processes and Materials of Manufacture – R. Lindberg
5. Production Technology – HMT
6. Workshop Technology (Volume I & II) – By Bawa

BMEP207: MANUFACTURING PROCESS	
Teaching Scheme: **Practical:** 2 Hrs/Week	**Examination Scheme (Laboratory)** **Continuous Assessment:** 25 Marks **External**: Nil
Credit :- 1	
List of Practicals (perform any 10 Experiment, Experiment No. 7 & 8 are compulsory)	**Hrs**

1.Tools for left hand and right hand turning	2
2.Tools for external and internal turning (Boring)	2
3.Study of cutting tool manual (any one)	2
4.Study of mechanisms in Lathe	2
5.Study of mechanism in drilling	2
6. Study of grinding operations	2
7. Job on arc welding/TIG/MIG welding	2
8. Practical on turning involving facing, step turning, taper turning, boring, boring with internal steps and taper, drilling (on lathe), internal and external threading	2
9.Practical on grinding	2
10. Study of moulding process	2
11. Practical on use of drilling machines.	2
12. Open ended Practicals. a) Simulation study of casting process b) Practical on soldering/brazing c) Industrial Visit	2

BMEL208: MECHATRONICS

Teaching Scheme:	**Examination Scheme (Theory)**
Lectures:-3 Hrs/Week	**Teachers Assessment:**20Marks
Tutorials: -- Nil	**Continuous Assessment:**20Marks
	EndSem Examination:60Marks

Credit: 3

Prerequisite (If any):

Applied Physics

Basic Electrical Engineering

Basic Electronics Engineering

Course Objective:

1. Understand key elements of Mechatronics system, representation into block diagram
2. Understand concept of transfer function, reduction and
3. Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller
4. Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application
5. Understand the system modeling and analysis in time domain and frequency domain.
6. Understand control actions such as Proportional, derivative and integral and study its significance in industrial applications.

Course Outcome: On successful completion of the course, students will

1. Able to understand the mechatronics system applications and functioning of sensors.
2. Able to understand the key elements of mechatronics system and its representation in terms of block diagram
3. understand the Programmable Logic Controller, Interfacing of Programmable Logic Controller and its
4. Should understand the Data Acquisition system Interfacing of Sensors to Data Acquisition system.
5. Should understand Time and Frequency domain analysis of system model (for control application)
6. Able to understand PID control implementation on real time systems

Course Contents	**Hrs**
Unit – I : 1: Introduction to Mechatronics, Sensors & Actuators	7

Introduction to Mechatronics and its Applications; Measurement Characteristics: Static and Dynamic; Sensors: Position sensors- Potentiometer, LVDT, incremental Encoder; Proximity sensors-Optical, Inductive, Capacitive; Temperature sensor-RTD, Thermocouples; Force / Pressure Sensors-Strain gauges; Flow sensors-Electromagnetic; Actuators: Stepper motor, Servo motor, Solenoids; Selection of Sensor & Actuator.	
Unit – II: Block Diagram Representation	7
Introduction to Mechatronics System Design; Identification of key elements of Mechatronics systems and represent into Block Diagram; Open and Closed loop Control System; Concept of Transfer Function; Block Diagram & Reduction principles; Applications of Mechatronics systems: Household, Automotive, Industrial shop floor.	
Unit – III : Programmable Logic Control	7
Introduction to PLC; Architecture of PLC; Selection of PLC; Ladder Logic programming for different types of logic gates; Latching; Timers, Counter; Practical examples of Ladder Programming. Applications in Industry.	
Unit – IV : Data Acquisition,	7
Introduction to Signal Communication & Types-Synchronous, Asynchronous, Serial, Parallel; Bit width, Sampling theorem, Aliasing, Sample and hold circuit, Sampling frequency; Interfacing of Sensors / Actuators to Data Acquisition system; 4 bit Successive Approximation type ADC; 4 bit R2R type DAC; Current and Voltage Amplifier.	
Unit – V: Frequency Domain Modeling and Analysis	7
Transfer Function based modeling of Mechanical, Thermal and Fluid system; concept of Poles & Zeros; Stability Analysis using Routh Hurwitz Criterion; Bode Plots: Introduction to Bode Plot, Gain Margin, Phase Margin, Relative Stability Analysis, Frequency Domain Parameters-Natural Frequency, Damping Frequency and Damping Factor; Mapping of Pole Zero plot with damping factor, natural frequency and unit step response	
Unit – VI : Control System	7
Proportional (P), Integral (I) and Derivative (D) control actions; PI, PD and PID control systems in parallel form; Unit step Response analysis via Transient response specifications: Percentage overshoot, Rise time, Delay time, Steady state error; Manual tuning of PID control; Linear Quadratic Control (LQR).	

Text Books:
1. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008
2. Bolton, Mechatronics - A Multidisciplinary approach, 4th Edition, Prentice Hall, 2009.
3. Mahalik, Mechatronics – Principles, concepts and applications, Tata Mc-Graw Hill publication, New Delhi
Reference Books:
1. Alciatore&Histand, Introduction to Mechatronics and Measurement system, 4th Edition, Mc-Graw Hill publication, 201
2. Bishop (Editor), Mechatronics – An Introduction, CRC Press, 2006
3. C. D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi
4. "Mechatronics" by J. Paolo Davim

BMEP208: MECHATRONICS	
Teaching Scheme: **Practical:**-- 2Hrs/week	**Examination Scheme (Laboratory)** **Continuous Assessment:** 25 Marks **External** : 25 Marks
Credit: 1	
List of Practical (Perform any 8 Experiments)	Hrs.
1. Measurement of Load / Force using a suitable sensor	2
2. Measurement of Temperature using a suitable sensor	2
1. Measurement of Position using a suitable sensor	2
2. Demonstration of **any one** of the following applications: ・Water Level Indicator ・Bottle Filling Plant ・Pick and Place Robot ・Any other. suitable application which comprises of components of Mechatronic system	2
3. Interfacing of suitable sensor with Data Acquisition system	2
4. Ladder Diagram simulation, using suitable software, for logic gates	2
5. Real time application of PLC using Ladder logic	2

6. Real time control of Temperature / Flow using PID control	2
7. Real time control of speed of DC motor using PID control	2
8. PID control Design, Tuning using suitable Simulation Software	2
9. Study of Modeling and Analysis of a typical Mechanical System (Estimation of poles, zeros, % overshoot, natural frequency, damping frequency, rise time, settling time)	2
10. Open Ended Practicals: a) Design of Mechatronic System (to be performed in a group of 4) b) Matlab Usage in Control System Design	2

BMEL209: FLUID MACHINERY	
TeachingScheme: **Lectures:** 4Hrs/Week **Tutorials:** Nil	**ExaminationScheme(Theory)** **TeachersAssessment:**20Marks **Continuous Assessment:**20Marks **End-Sem Examination:**60Marks
Credits: 4	
PREREQUISITE(IFANY):	
1. Fluid Mechanics	
2. Engineering Mathematics	
COURSE OBJECTIVES:	
1. A foundation in the fundamentals of fluid mechanics	
2. Practice in the analytical formulation of fluid mechanics problems using Newton's Laws of motion and thermodynamics	
3. An introduction to experimental methods	
4. An exposure to practical applications, work on a small design project, and the writing of a technical report related to the design project	
COURSE OUTCOMES: On successful completion of the course, students will have capability	
1. Able to explain the momentum principle and its applications to various objects.	
2. Able to summarize the working principles of reaction turbines& able to plot performance characteristics.	
3. Able to explain the working principle of centrifugal pumps &plot the performance characteristics.	
4. Able to discuss the concepts of compressible flow and nozzle design.	
5. Able to summarize the working principles of different hydrostatic systems.	
6. Able to analyze the basic concepts and applications of CFD.	
COURSECONTENTS	**Hrs**
UNIT – I : INTRODUCTION TO FLUID MACHINES & IMPULSE HYDRAULIC TURBINES	8
Impulse momentum principle and its applications, Force excreted on fixed plate, moving flat plate and curved vanes, series of plates, velocity triangles and their analysis, work done equations , efficiency. Pelton wheel- construction, principle of working, velocity diagrams and analysis, design aspects, governing and performance characteristics, specific speed, selection of turbines, multi-jet.	
UNIT – II : REACTION WATER TURBINES	8

Classifications, Francis, Propeller, Kaplan Turbines, construction features, velocity diagrams and analysis, DOR, draft tubes- types and analysis, cavitation causes and remedies, specific speed, performance characteristics and governing of reaction turbines, selection of turbines.	
UNIT – III : PUMPS	7
Classification of rotodynamic pumps, components of centrifugal pump, types of heads, velocity triangles and their analysis, effect of outlet blade angle, cavitation, NPSH, Thoma's cavitation factor, priming of pumps, installation, specific speed, performance characteristics of centrifugal pump, series and parallel operation of pumps, system resistance curve, selection of pumps. Reciprocating pumps: Types, Component and Working of Reciprocating pump, Discharge, Work done and powerrequired to drive for single acting and double acting, Coefficient of discharge, slip,Effect of acceleration of piston on velocity and pressure, indicator diagram, Air Vessel	
UNIT – IV : COMPRESSIBLE FLOW	7
Perfect gas relationship, speed of sound wave, mach number, Isothermal and isotropic flows, Shock waves, fanno and Rayliegh lines.	
UNIT – V : HYDROSTATIC AND HYDROKINETIC SYSTEMS	8
Hydrostatic systems, their function, components and application such as Hydraulic press, lift, crane and fluid drive for machine tools. Intensifier and accumulator. Hydrokinetic systems: Fluid couplings and torque converter.	
UNIT – VI : EXPERIMENTAL TESTING AND MODELLING	7
Model Testing: application to hydraulic turbines and hydrodynamic pumps. Water Lifting devices, incomplete similarities, Wind tunnel testing, and flow with free surfaces.	

Text Books: (Book Title, Name of the author, name of the Publisher, edition, year of publication
1. V.P. Vasandani, "Hydraulic Machines – Theory and Design"
2. Bansal R.K., "Fluid Mechanics and Fluid Machines", Laxmi Publications,7th edition 2002
3. Modi&Seth,"Fluid Mechanics & Fluid Machinery",Standard Book House 2002.

Reference Books:
1. R.K.Rajput, "A Text book of Fluid Mechanics and Hydraulic Machines", S.Chand Co.Ltd.,2002
2.Massey B.S., "Mechanics of Fluids", Van Nostrand Reinhold Co., 6th edition 1989
3.A.K. Jain, „Fluid Mechanics"
4. D S. Kumar, "Fluid mechanics and Fluid Power Engineering"
5.J.J. Pippenger, "Industrial Hydraulics"
6. JagdishLal, "Hydraulic Machines".

BMEP209: FLUID MACHINERY	
TeachingScheme: **Practical:** 2Hrs/Week	**ExaminationScheme(Laboratory)** **Internal(TW):** Nil **External(OR)**: 25 Marks **External(PR)**: Nil
Credits: 1	
LIST OF PRACTICALS	Hrs.
(Minimum eight to be performed)	
1. Verification of impulse momentum principle	2
2. To find the value of coefficient of a given venturi meter fitted in a pipe.	2
3.To find the value of coefficient of discharge for a given of orifice meter.	2
4. Study and trial on pelton wheel and plotting of main / operating characteristics	2
5.Study and trial on Francis Turbineand plotting of main / operating characteristics	2
6.Study and trial on Kaplan Turbineand plotting of main / operating characteristics	2
7. Study and trial on centrifugal pump and plotting of operating characteristics	2

8. Study experiment on Fluidic devices	2
9. Study of different types of nozzles	2
10. Visit to Hydro Electric Power Plant.	2
11. Open Ended Practical: Simulation of any Two type of turbo machine	2

BMEP210: INDUSTRIAL SAFETY PRACTICES AND WORK CULTURE	
TeachingScheme: **Lectures:** 1Hr/Week **Tutorials:** Nil	**ExaminationScheme(Theory)** **TeachersAssessment:** Nil **Continuous Assessment:** Nil **End-Sem Examination:** Nil
Credits: --	
Audit: G	
COURSE OBJECTIVES:	
1. To enable understanding of the importance of industrial safety	
2. To develop personal habits and work culture aimed at minimizing hazards, accidents and waste	
COURSE OUTCOMES: At the end of the course the student shall be able to:	
1. Implement Industrial safety rules and practices.	
2. Follow the work culture in industry	
3. Understand six sigma data-driven approach and ISO Standards.	
4. Know the principles of total quality management and peculiarities of their implementation.	

COURSECONTENTS	Hrs.
1. Study and working of Thermal power stations, types and applications.	4
2. Study of Production industries, types, working process and case study.	4
3. Industrial Safety Practices, Types of risk, safety norms in typical industries and industrial Audit	4
4. Introduction and case studyof ISO in production industries, Six sigma norms, TQM/ KANBAN/KHAIZAN.	4

BMEP210: INDUSTRIAL SAFETY PRACTICES AND WORK CULTURE	
TeachingScheme: **Practical:** 2Hrs/Week	**ExaminationScheme(Laboratory)** **Internal(TW):** Nil **External(OR)**: Nil **External(PR)**: Nil
Credits: Audit Course	

It is expected to visit the nearby industry and study the industrial safety practices and work culture. Students are required to submit the brief reporton the safety practices and workculture in the industry. The following list of Practicals/ industrial visits can be made(Perform any 4):	Hrs.
1) Study and Visit to thermal power station and report submission.	4
2) Study and Visit to Production Industry and report submission.	4
3) Study and Visit to Industry to study safety practices and safety audit	4
4) Study of 6 sigma &ISO in Industry.	4
5) Study of TQM/KAIZAN	6

BMEGP203: GENERAL PROFICIENCY-III: Hobby classes

Teaching Scheme:	**Examination Scheme(Theory)**
Lectures: 1Hrs/Week	**Teachers Assessment:** Nil
Tutorials: Nil	**Continuous Assessment :** Nil
Practical: 2Hrs/Week	**End Sem Examination:** Nil

Credits -

Audit course:G

PREREQUISITE(IFANY):

NIL

COURSE OBJECTIVES:

1. To enhance the inherent qualities of oneself and provide a platform to show hidden talent.
2. To nurture one's special capability and interest in activities like sports, drama, singing.
3. To help express oneself and be more compatible with outer world in the hobby domain.
4. To enhance creativity & imagination to flow freely

COURSE OUTCOMES: Upon successful completion of the course students will be able to

1. Explore and demonstrate the inherent talents within.
2. Develop self-expression and communication skills.
3. Improve new skill and increase self-confidence and to boost selfEsteem.
4. Participate in extra-curricular activities like sports, indoor games, Dance and movie club
5. Improve technical skill by Participating in events like BAJA, SUPRA, ROBO Clubs, etc.

COURSECONTENTS	**Activities**	**Hrs**
Stress management sessions	Yoga, pranayam, meditation, relaxation techniques	2
Outdoor activities	Nature walks, treks, cycling, horse riding	2
Painting	Canvas, fabric , Sketching, knife, glass	2

Music (vocals and instrument)	Singing, Guitar, Synthesizer, Harmonium, Piano, Flute	2
Dance	Bharatnatyam, Kathak	2
Indoor sports	Chess, carom, table tennis	2
Movie club	Motivational movies and documentaries to be shown	2
Other creative skills	Embroidery , knitting, use of making things from waste materials, photography, puzzle solving	2
Developing technical skills	Robot Club, IOT Based clubs, Quality Circle, BAHA clubs, SAE	2