GOVT. COLLEGE OF ENGINEERING
AMRAVATI

DEPARTMENT OF MECHANICAL ENGINEERING

CURRICULUM

For

B. TECH. (Mechanical Engineering)

From 2019 – 20 batch

PROGRAM OBJECTIVES

I. To prepare students for successful careers in industry/ higher studies /R&D institutions that meet global needs.

II. To provide students with solid foundation in basic science and basic engineering required to solve and analyze mechanical engineering problems.

III. To develop ability among students to solve industrial, environmental, Techno-social problems with latest and appropriate mechanical engineering techniques and tools available

IV. To inculcate professional skill, ethical responsibility, team work and leadership qualities in students.

V. To promote awareness of entrepreneurship, self-education, lifelong learning and to develop sense of social responsibility.

PROGRAM OUTCOMES

I. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

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

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

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

VI. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and

cultural issues and the consequent responsibilities relevant to the professional engineering practice.

VII. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

VIII. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

X. 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.

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

XII. 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.

PROGRAM SPECIFIC OUTCOMES

1. Identify Mechanical Engineering related real life issues/ problems in industries, society and provide feasible solution

2. Apply the knowledge of the basic streams of Mechanical Engineering viz. thermal, design and production system to design mechanical system and product development

3. Plan and implement the activities in the small, medium and large enterprises as a part of team or as an individual

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

MECHANICAL ENGINEERING DEPARTMENT

SCHEME FOR III & IV Semester B. Tech. (Mechanical Engineering) as per AICTE guidelines

Category	Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						Credits
							Theory			Practical		Total	
			L	T	P	Total	MSE	TA	ESE	ICA	ESE		
	Semester – III												
BSC	SHU321 A *SHU322A	Differential Equations and Probability *Integral Calculus and Probability	3	-	-	3	30	10	60	-	-	100	3
PCC	MEU321	Thermodynamics	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU322	Manufacturing Processes	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU323	Materials Engineering	4	-	-	4	30	10	60	-	-	100	4
ESC	MEU324	Machine Drawing	3	-	-	3	30	10	60	-	-	100	3
MC	SHU323	Introduction to Constitution of India	1	-	-	1	-	20	30	-	-	50	0
LC	MEU325	Materials Engineering Lab	-	-	2	2	-	-	-	25	25	50	1
LC	MEU326	Machine Drawing Lab	-	-	2	2	-	-	-	25	25	50	1
			19	**-**	**4**	**23**	**150**	**70**	**330**	**50**	**50**	**650**	**20**
	Semester – IV												
BSC	SHU425	Human value and ethics	1	-	-	1		20	30	-	-	50	0
PCC	MEU421	Applied Thermodynamics-I	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU422	Fluid Mechanics	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU423	Manufacturing Technology	4	-	-	4	30	10	60	-	-	100	4
PCC	CEU430	Strength of Material	4	-	-	4	30	10	60	-	-	100	4
MC	SHU422	Environmental ~~Science~~ Studies	1	-	-	1	-	20	30	-	-	50	0
LC	MEU424	Fluid Mechanics Lab	-	-	2	2	-	-	-	25	25	50	1
LC	CEU431	Strength of Material Lab	-	-	2	2	-	-	-	25	25	50	1
			18		**4**	**22**	**120**	**80**	**300**	**50**	**50**	**600**	**18**

L – Theory lecture, T – Tutorial; P – lab work: Numbers under teaching scheme indicated contact clock hours
BSC- Basic Science; PCC – Program Core Course; ESC- Engineering Science; MC – Mandatory Course; LC- Lab Course
MSE- Mid Semester examination; **TA**- Teacher Assessment; **ICA** – Internal Continuous Assessment; **ESE** – End Semester Examination

***For the students directly admitted to second year (Lateral entry)**

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

MECHANICAL ENGINEERING DEPARTMENT

SCHEME FOR V & VI Semester B. Tech. (Mechanical Engineering) as per AICTE guideline

Category	Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						Credits
							Theory			Practical		Total	
			L	T	P	Total	MSE	TA	ESE	ICA	ESE		
	Semester – V												
PCC	MEU 521	Heat Transfer	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU522	Machine Design –I	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU523	Applied Thermodynamics-II	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU524	Theory of Machines	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU525	Turbo machines	4	-	-	4	30	10	60	-	-	100	4
MC	SHU522	Essence of Indian Traditional Knowledge	-	-	-	-	-	-	30	-	-	30	0
LC	MEU526	Thermal Lab-I	-	-	2	2	-	-	-	25	25	50	1
LC	MEU527	Theory of Machine Lab	-	-	2	2	-	-	-	25	25	50	1
PCC	MEU528	Seminar	-	-	2	2	-	-	-	50	-	50	1
			20		**6**	**26**	**150**	**50**	**330**	**100**	**50**	**680**	**23**
	Semester – VI												
PCC	MEU621	Instrumentation & Control	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU622	New and Renewable Energy Sources	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU623	Machine Design-II	4	-	-	4	30	10	60	-	-	100	4
PEC	MEU624	Program Elective-I	3	-	-	3	30	10	60	-	-	100	3
PEC	MEU625	Program Elective-II	3	-	-	3	30	10	60	-	-	100	3
OEC	MEU626	Open Elective-I	3	-	-	3	30	10	60	-	-	100	3
LC	MEU627	Design Lab	-	-	2	2	-	-	-	25	25	50	1
PROJECT	MEU628	Minor Project	-	-	6	6	-	-	-	50	50	100	3
			20		**8**	**29**	**180**	**60**	**360**	**75**	**75**	**750**	**25**

L – Theory lecture, T – Tutorial; P – lab work: Numbers under teaching scheme indicated contact clock hours
BSC- Basic Science; PCC – Program Core Course; ESC- Engineering Science; MC – Mandatory Course; LC- Lab Course
MSE- Mid Semester examination; **TA**- Teacher Assessment; **ICA** – Internal Continuous Assessment; **ESE** – End Semester Examination

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

MECHANICAL ENGINEERING DEPARTMENT

SCHEME FOR VII & VIII Sem. B. Tech. (Mechanical Engineering) as per AICTE guidelines

Category	Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme						Credits
							Theory			Practical		Total	
			L	T	P	Total	MSE	TA	ESE	ICA	ESE		
	Semester – VII												
PCC	MEU 721	Automation in Manufacturing	4	-	-	4	30	10	60	-	-	100	4
PCC	MEU 722	Gas Dynamics and Jet Propulsion	3	-	-	3	30	10	60	-	-	100	3
PEC	MEU 723	Program Elective-III	3	-	-	3	30	10	60	-	-	100	3
PEC	MEU724	Program Elective-IV	3	-	-	3	30	10	60	-	-	100	3
PEC	MEU 725	Program Elective-V	3	-	-	3	30	10	60	-	-	100	3
OEC	MEU 726	Open Elective-II	3	-	-	3	30	10	60	-	-	100	3
LC	MEU727	Manufacturing Lab	-	-	2	2	-	-	-	25	25	50	1
LC	MEU 728	Thermal Lab-II	-	-	2	2	-	-	-	25	25	50	1
			19	**-**	**4**	**23**	**180**	**60**	**360**	**50**	**50**	**700**	**21**
	Semester – VIII												
PEC	MEU 821	*Program Elective-VI	3	-	-	3	30	10	60	-	-	100	3
PROJECT	MEU 822	Project and Seminar / Industry Internship Project	-	-	24	24	-	-	-	200	200	400	12
			3	**-**	**24**	**27**	**30**	**10**	**60**	**200**	**200**	**500**	**15**

***Students going for Industrial Project/Thesis will complete above course through online platform such as MOOCs. , NPTL etc or by self-study mode and will directly appear for ESE only. (Total internal marks (MSE+TA) will be awarded proportional to ESE marks secure)**

L – Theory lecture, T – Tutorial; P – lab work: Numbers under teaching scheme indicated contact clock hours
BSC- Basic Science; PCC – Program Core Course; ESC- Engineering Science; MC – Mandatory Course; LC- Lab Course
MSE- Mid Semester examination; **TA-** Teacher Assessment; **ICA** – Internal Continuous Assessment; **ESE** – End Semester Examination

Government College of Engineering, Amravati

(Equivalence of Courses in Old Scheme with New Scheme

B. Tech : Mechanical Engineering

Year : Second Year (Semester – III & IV)

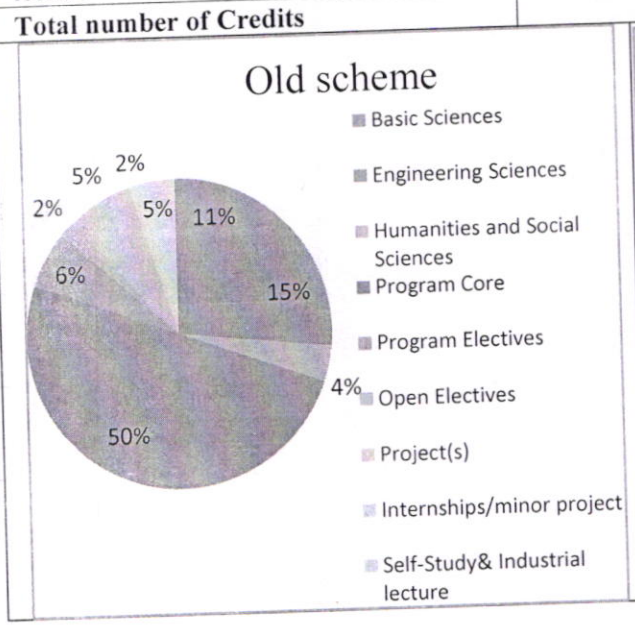
Sr. No.	Course in old scheme			Course in new Scheme		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1.	MEU301	Material Science and Engineering	03	MEU323	Materials Engineering	4
2.	SHU301	General Proficiency - II	02	**No equivalence**		
3.	MEU302	Engineering Thermodynamics	04	MEU321	Thermodynamics	4
4.	SHU302	Engineering Mathematics -III	03	SHU321A *SHU322A	Differential Equations and Probability *Integral Calculus and Probability	4
5.	CEU303	Strength of Materials	04	CEU425	Strength of Material	4
6.	MEU303	Material Science and Engineering Lab.	01	MEU325	Materials Engineering Lab	1
7.	MEU307	Strength of Materials Lab.	01	CEU431	Strength of Material Lab	1
8.	EEU311	Electric Drives and Control	04	**No equivalence**		
9.	EEU312	Electric Drives and Control Lab.	01	**No equivalence**		
10.	MEU401	Fluid Mechanics	04	MEU422	Fluid Mechanics	4
11.	MEU402	Kinematics of Machines	04	No equivalence		
12.	MEU403	Thermal Engineering & Energy Conversion	4	MEU421	Applied Thermodynamics-I	4
13.	MEU404	Manufacturing Processes	04	MEU322	Manufacturing Processes	4
14.	MEU405	Machine Drawing	02	MEU324	Machine Drawing	3
15.	MEU406	Fluid Mechanics Lab	01	MEU424	Fluid Mechanics Lab	1
16.	MEU407	Kinematics of Machines Lab	01	**No equivalence**		
17.	MEU408	Manufacturing Processes Lab	01	**No equivalence**		
18.	MEU409	Computer Aided Drafting Lab	02	MEU326	Machine Drawing Lab	1
19.	**No equivalence**			MEU423	Manufacturing Technology	4
20.	**No equivalence**			SHU425	Human value and ethics	0
21.	**No equivalence**			SHU422	Environmental Science	0
22.	**No equivalence**			SHU323	Introduction to Constitution of India	0

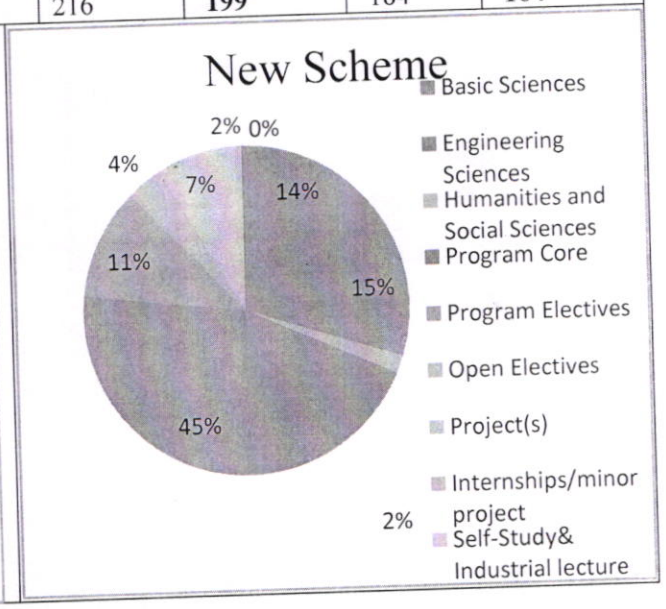
Department of Mechanical Engineering
Equivalence Scheme for *online courses*
Programme Name:-B.Tech. Mechanical Engineering

Course Code	Name of the Course	Credits	Equivalent NPTEL/MOOC Course of duration 12-14week and covering 80% course contents / Virtual lab link for lab course	Credits	Course Starting date
Semester – III					
SHU321	Engineering Mathematics-III	4	--	--	--
MEU321	Thermodynamics	4	NPTEL Course: Concepts of Thermodynamics by Prof. Suman Chakraborty & Prof. Aditya Bandopadhyay, IIT, Kharagpur. Link for the course: https://nptel.ac.in/courses/112/105/112105266/ Duration – 12 Weeks	4	Enrolment Ends: September 21, 2020 Course Start Date: 14.09.2020 Course End Date: 04.12.2020 Exam Date: December 18-20, 2020 Exam Registration Date: 14.09.2020
MEU322	Manufacturing Processes	4	Theory of Production Processes 12 weeks duration 14 September to 04 December 2020 Exam date 20 December 2020 https://nptel.ac.in/courses/112/107/112107239/	3	14 September 2020
MEU323	Materials Engineering	4	Basics of Materials Engineering https://swayam.gov.in/nd1_noc20_me78/preview		14 Sep – 20 Dec, 2020
MEU324	Machine Drawing	2	--	--	--
SHU322	Introduction to Constitution of India	0	--	--	--
MEU325	Materials Engineering Lab	1	--	--	--
MEU326	Machine Drawing Lab	1	--	--	--

COMPONENTS OF CURRICULUM
(Program Duration : 4 Years)

Course Component	Curriculum Content (% of total number of credits of the program)		Total number of contact hours		Total number of credits	
SCHEME	OLD	**NEW**	OLD	**NEW**	OLD	**NEW**
Basic Sciences	11.41	**14.63**	23	**26**	21	**24**
Engineering Sciences	15.21	**15.24**	35	**35**	28	**25**
Humanities and Social Sciences	03.80	**01.82**	11	**04**	07	**03**
Program Core	50.00	**45.12**	112	**82**	92	**74**
Program Electives	05.97	**10.97**	13	**18**	11	**18**
Open Electives	01.63	**03.65**	03	**06**	03	**06**
Project(s)	05.43	**06.70**	12	**22**	10	**11**
Internships/minor project	01.63	**01.82**	2	**06**	03	**03**
Self-Study& Industrial lecture	04.89	-	2		09	
Total number of Credits			216	**199**	184	**164**





Equivalence B. Tech. Second Year SH Courses A.Y. 2020-21

S.N.	Course in old scheme			Equivalent course in new Scheme		
	Course Code	Course name	No. of Credits	Course Code	Course name	No. of Credits
1	SHU301	Engineering Mathematics- III	03	SHU321A	Differential Equations And Probability	03
2		No Equivalence		SHU322A	Integral Calculus And Probability	03
3	SHU304	Engineering Mathematics- III	03	SHU321B	Transform And Linear Algebra	04
4		No Equivalence		SHU322B	Differential Equation And Transform	04
5	SHU303	Engineering Mathematics- III	03	SHU321C	Transform And Statistical Methods	04
6		No Equivalence		SHU322C	Integral Calculus And Probability	04
7		No Equivalence		SHU323	Introduction To Constitution Of India	00
8		No Equivalence		SHU324	Effective Technical Communication	03
9		No Equivalence		SHU325	Human Values And Ethics	00
10	SHU203	Environmental Studies	03	SHU422	Environmental Studies	00
11		No Equivalence		SHU425	Human Values And Ethics	00
12		No Equivalence		SHU525	Human Values And Ethics	00
13		No Equivalence		SHU725	Human Values And Ethics	00
14	SHU305	General Proficiency- II	2		No Equivalence	
15	SHU401	Engineering Mathematics- IV	3		No Equivalence	
16	SHU402	Engineering Mathematics Lab	2		No Equivalence	
17	SHU403	Engineering Mathematics Lab	2		No Equivalence	

Pulkane

5/ **Head, Mathematics**

Member secretary
BoS Science & Humanities

S.V. Shinde

Chairman
BoS Science & Humanities

SHU321A DIFFERENTIAL EQUATIONS AND PROBABILITY

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. To learn Laplace transform and its properties. Apply it to solve differential equation.
II. To introduce the solution methodologies for second order Partial Differential Equations.
III. To study applications of partial differential equations in vibration of string and heat flow.
IV. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.

Laplace Transform: Definition, Properties of Laplace Transform, Laplace transform of periodic functions. Inverse Laplace transform, convolution theorem, unit step function, delta function, evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method.

Partial Differential Equations: Solutions of first order linear PDEs, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

Applications of Partial Differential Equations: Method of separation of variables, equation of vibrating string, solution of wave equation by D'Alembert's method, one dimensional heat flow, two dimensional heat flow.

Random variables and Probability Distributions: Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020,44th edition.
2. A text book of Engineering Mathematics,N.P. Bali and Manish Goyal, Laxmi Publications, Reprint,2010.

References:

1. Advanced Engineering Mathematics,Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Introduction to Probability Theory,P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003(Reprint).
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India,2002.
4. Advanced Engineering Mathematics, H.K.Das, S.Chand& Company Pvt.Ltd,2014.
5. Higher Engineering Mathematics, B.V,Ramana,TataMcGraw Hill Publishing company Ltd.,New Delhi,2008,6th edition.

Course Outcomes: After successful completion of this course student will be able to

SHU321A.1 Develop different techniques of solving partial differential equations.
SHU321A.2 Implement these techniques to evaluate the engineering problems.
SHU321A.3 Develop techniques needed to calculate probabilities and describe the

	properties of discrete and continuous distribution functions.
SHU321A.4	Use the knowledge of Laplace Transform to solve differential equations.

*SHU322A INTEGRAL CALCULUS AND PROBABILITY

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. To equip students with solution techniques of ordinary differential equations of higher order.
II. To learn Laplace transform, its properties and apply it to solve differential equations.
III. To equip students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
IV. To introduce the solution methodologies for second order Partial Differential Equations.
V. To learn special functions and utilize it in the evaluation of multiple integral.

Course Contents:

Ordinary differential equations of higher orders: Linear differential equation with constant coefficient, complementary function, particular integral, complete solution; method of variation of parameters.

Integral Calculus: Beta and Gamma functions and their properties; Evaluation of double integrals (Cartesian &polar), change of order of integration.

Laplace Transform: Definition, Properties of Laplace Transform, Laplace transform of periodic functions. Inverse Laplace transform, convolution theorem, unit step function, delta function, solving ODEs by Laplace Transform method.

Partial Differential Equations: Solutions of first order linear PDEs, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

Random variables and Probability Distributions: Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Binomial, Poisson and Normal distributions and applications.

Text Books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020, 44th edition.
2. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.

Reference books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003 (Reprint).
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. Advanced Engineering Mathematics, H. K. Das, S. Chand & Company Pvt.Ltd, 2014.
5. Higher Engineering Mathematics, B.V Ramana, Tata Mc Graw Hill Publishing company

Ltd., New Delhi,2008, 6th edition.

Course Outcomes: After completion of course, the students will be able to:

SHU321.1A	Develop different techniques of solving partial differential equations.
SHU321.2A	Evaluate double integrals with the help of special functions
SHU321.3A	Solve ordinary differential equations of higher order.
SHU321.4A	Develop techniques needed to calculate probabilities and describe the properties of discrete and continuous distribution functions
SHU321.5A	Find Laplace transform of given function and apply it to solve differential equations.

MEU321 THERMODYNAMICS

Teaching Scheme: 04 L **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

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

Course Contents:

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

Pure Substances - Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property;

Evaluation of *S* for solids, liquids, ideal gases and ideal gas mixtures undergoing various

processes; Determination of *S* from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Gas Power Cycles; Basic vapor compression cycle and comparison with Carnot cycle.

Text Books:

1. Thermodynamics: An Engineering Approach, Yunus Cengel and Michael Boles, 9TH Edition, McGraw Hill, 2019
2. Engineering Thermodynamics, P. K. Nag, 6TH Edition, McGraw Hill, 2017

Reference books:

1. Fundamentals of Thermodynamics, Richard Sonntag, Claus Borgnakke ,9TH edition, John Wiley and Sons, 2016
2. Fundamentals of Engineering Thermodynamics, Michael J. Moran, Howard Shapiro, 8TH edition, John Wiley & Sons, 2014
3. Engineering Thermodynamics, Jones, J. B. and Duggan, R. E., Prentice Hall of India

Course Outcomes: After completion of course, the students will be able to:

MEU321.1	Apply energy balance to systems and control volumes, in situations involving heat and work interactions
MEU321.2	Evaluate changes in thermodynamic properties of substances
MEU321.3	Evaluate and compare the performance of energy conversion devices
MEU321.4	Differentiate between high grade and low grade energies

MEU322 MANUFACTURING PROCESSES

Teaching Scheme: 04 L **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I Impart the critical knowledge of metal melting, casting, mechanical working of metals and different joining processes
II Prepare students understand working principles of additive manufacturing processes their selection based on quality and productivity
III Inculcate the fundamentals of unconventional machining processes

Course Contents:

Casting and Moulding: Pattern materials, allowances, Types of patterns, Design considerations in pattern making, Color codes for patterns and core boxes. Basic principle and Terminology of sand casting, gating system, types of gate, Directional and Progressive solidification. General properties of moulding sands, Types of sands, Preparation of sand moulds of different types, Moulding processes, core making.

Technology of Melting and Special Casting Methods: Melting furnaces pit, open hearth, gas fired cupola and electric hearth furnaces, Electric furnaces -Direct Arc, Indirect arc and electric induction furnace, Selection of furnace. Modernization and Mechanization of Foundries, permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting, Die casting equipments and processes for Gravity, Pressure and Vacuum casting methods

Defects, Inspection and Testing of Casting: Various defects, their causes and remedies, cleaning and inspection methods of casting.

Additive Manufacturing Processes: Stereolithography (SLA), Liquid thermal polymerization (LTP), Fused Deposition Modeling (FDM), Ballistic Particle Manufacturing (BPM), Selective Laser Sintering (SLM), Laser engineered net shaping (LENS), Binder Jet Printing (BJP)

Mechanical Working of Metals: Principle of Hot and cold working processes, Different types of hot and cold working processes, e.g. Rolling, types of rolling forging operations, extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Spinning, embossing and coining, squeezing and bending operations, rotary swaging

Joining Processes, Welding Defects, Testing and Inspection of Welds: Introduction to riveting, soldering, brazing and welding. Gas welding, working principle and its application, Arc welding: arc initiation, arc maintenance, and arc control, TIG/ MIG/ SAW/ Resistance welding: working principle and its application, Working principle and applications of Friction Welding, Forge Welding, Plasma arc, and Thermit Welding. Ultrasonic, Electro slag, Electron Beam, laser welding.Various welding defects, weld testing methods.

Unconventional Machining Processes Mechanical Processes: -Ultrasonic Machining principle and applications, process parameters, Abrasive and water abrasive jet machining. Thermal processes: -Election Beam Machining -Generation of beam, principle and applications, Laser Beam machining: Plasma-arc machining-Concept and generation of plasma, principle of PAM, applications. Electro Chemical Machining-Classification,

fundamentals, Electro mechanical milling. Electric discharge Machining –EDM, wire EDM, Mechanism of material removal, process parameters, advantages and applications

Text Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014
2. Workshop Technology, HajraChaudharyVol I , 10thEdition,DhanpatRai and Co (P) ltd

Reference Books:

1. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
2. Degarmo, Black &Kohser, Materials and Processes in Manufacturing

Course Outcomes: After completion of course, the students will be able to:

MEU322.1. Illustrate the fundamentals of metal melting, casting, mechanical working of metals, their necessity and importance

MEU322.2. Explain working principles and classify additive manufacturing processes.

MEU322.3. Differentiate and compare joining processes in terms of application, function, advantages, disadvantages, quality and productivity

MEU322.4. Interpret necessity, principle, advantages, disadvantage, limitations, applications of unconventional machining processes

MEU323 MATERIALS ENGINEERING

Teaching Scheme: 04 L **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
II. To provide a detailed interpretation of equilibrium phase diagrams
III. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Course Contents:

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Mechanical Property Measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.

Static Failure Theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, other failure mechanisms like creep, stress corrosion cracking, embrittlement, Introduction to non-destructive testing (NDT)

Alloys, Substitutional and Interstitial Solid Solutions- Phase Diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

Heat Treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

Alloying of steel, properties of stainless steel and tool steels, specifications of some commonly used steels for engineering applications (eg. EN, AISI, IS),maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys

Text Books:

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

2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011

Reference Books:

1. Mechanical Metallurgy, G.E. Dieter, 3rd Edition, Mc-Graw Hill International, London, 1999.
2. Physical Metallurgy for Engineers, 4th Edition, Clarke and Varney,. 2004.
3. Powder Metallurgy, A.K. Sinha 1st Edition., 1991.
4. Engineering Physical Metallurgy, Y. Lakhtin, 2nd Edition, Mir Publications, 1999.

Course Outcomes: After completion of course, the students will be able to:

MEU323.1	Identify crystal structures for various materials and understand the defects in such structures
MEU323.2	Understand how to tailor material properties of ferrous and non-ferrous alloys
MEU323.3	How to quantify mechanical integrity and failure in materials

MEU324 MACHINE DRAWING

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. Helping the student in drafting their technical ideas.
II. Creating knowledge about the various practices with regard to the dimensioning, sectioning and development of views.
III. Understanding the importance of the linking functional and visualization aspects in the preparation of the part drawings.
IV. Preparation of the part or assembly drawings as per the conventions.
V. Interpretation of machine drawings that in turn help the students in the preparation of the jobs, components, etc.

Course Contents:

Sectional Views: conversion of pictorial view into sectional orthographic projections, missing views.

Development of Surfaces: Development of surface of cubes, prisms, cylinder, pyramids, cones etc

Intersection of Surfaces: Interpenetration of solids, prism and prism, cylinder and cylinder, cylinder and prism, cone and cylinder, cone and prism.

Assembly Drawing: Preparation of detailed and assembly drawing of simple machine assemblies like pedestal bearing, Plummer block, simple eccentric, stuffing box, cross head, connecting rod, tail stock, tool post, c-clamp, screw jack, boiler safety valve etc.

Introduction to Modelling by using Pro/Engineer /CATIA Software.

Text Books:

1. Machine drawing, N.D.Bhatt, 38th Edition ,Charotar Publisher, 2003
2. Machine Drawing, N.Sidheshwar, Shastry, Kanhaiah, 4th Edition, Tata Mcgraw Hill, 2005

Reference Books:

1. Machine Drawing, Narayan, K.L.Reddy, 2nd Edition, New AGE International Publishers, 2004
2. Machine Drawing, P.J.Shah, 3rd Edition, Shah Publishers, 1997
3. Computer Graphics & Design, P.Radhakrishnan, 3rd Edition, Dhanpat Rai & Sons, 2009
4. Using AUTOCAD, James E Fuller, 9th Edition, Denmark Publishing Company, 2004
5. Machine Drawing, R.K.Dhawan, 4th Edition, S.Chand& Co.,2006

Course Outcomes: After completion of course, the students will be able to:

MEU324.1. Draw the development of surfaces for sheet metal working applications.
MEU324.2. Understand the representation of materials used in machine drawing.
MEU324.3. Draw the machine elements including keys, couplings, cotters, riveted, bolted and welded joints.
MEU324.4. Construct an assembly drawing using part drawings of machine components.

MEU324.5. Represent tolerances and the levels of surface finish of machine elements Develop skills to model the behaviour of structures under mechanical and thermo-mechanical loads.

SHU323 INTRODUCTION TO CONSTITUTION OF INDIA

Teaching Scheme: 01 L **Total: 01** **Credits: 00**
Evaluation Scheme: 20 TA+30 ESE **TOTAL MARKS: 50**
Duration of ESE: 1 hrs. 30 min

Course Objectives:

To acquaint students about constitution of India, Fundamental rights, fundamental duties, electoral process and role of central, state and local government and its administration

Course Contents:

Unit I: Introduction to Constitution of India
Salient features of the Constitution of India, Preamble of the Constitution, fundamental rights and fundamental duties, Directive Principles of State Policy and relevance of directive principles. Parliamentary Form of Government in India- President, Vice-President, Prime Minister along with council of Minister, Parliament, Supreme court, Electoral process in India. Amendment Procedure.

Unit II: State executives Governor, chief minister, state legislature, high courts of state,

Unit III: Role and functions of local self government- Municipalities in India, with special reference to 73rd amendment. Panchayat Raj in India with special reference to 74th amendment.

Course outcomes:

On the successful completion of this course, Students shall be able to-

1. Understand and remember the knowledge of basic information about Indian Constitution.
2. Apply the knowledge of fundamental rights and fundamental duties.

Reference Books:-

1. An Introduction to Constitution of India, M.V.Pylee, Vikas Publishing, 2002
2. Constitution of India, Dr. B. R. Ambedkar, Government of India Publication
3. Latest Publications of Indian Institute of Human Rights, New Delhi

MEU325 MATERIALS ENGINEERING LAB

Teaching Scheme: 02 P **Total: 02** **Credits: 01**
Evaluation Scheme: 25 Internal + 25 External **TOTAL MARKS: 50**

Course Objectives:

I. To reinforce the concepts learnt in the theory classes of Materials Engineering (MEU323) by carrying out various experiments
II. Students will learn specimen preparation for optical microscopy and by using optical microscope study microstructures of various metals/alloys which are used in industries for various applications
III. To compare the composition and properties of various ferrous and non-ferrous metals/alloys
IV. To carry out mechanical tests/heat treatments to evaluate various mechanical properties

Note: It is representative list of experiments. The instructor may choose minimum eight experiments as per his/her requirement (so as to cover entire content of course MEU323) from the list given below.

List of Experiments:

1. Study of metallurgical microscope.
2. Preparation of specimen for microstructure examination
3. Molding of specimen for microstructure examination with the help of mounting press/ cold setting resin.
4. Study and drawing of microstructure of annealed and normalized steels.
5. To carry out hardening and tempering of steel.
6. Study of Jominy end quench test for hardenability of steel.
7. To measure hardness using Rockwell Hardness Tester.
8. Study and drawing of microstructures of various cast irons.
9. Study and drawing of microstructures of various non –ferrous metals and alloys.
10. To study and perform impact test.
11. To measure hardness using Brinell Hardness Tester
12. Study of image analyzer
13. Study of scanning electron microscopy
14. Study of transmission electron microscopy
15. Study and drawing of microstructures of steels

Note:
ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired.

ESE: The end semester Exam for practical may/shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of the laboratory course, students will be able to

MEU325.1. Prepare specimen for optical microscopy and use optical microscope for the study of microstructures of various metals/alloys and recognize/ identify various phases present in metals/alloys and their effect on mechanical properties

MEU325.2. Understand the effect of heat treatment on the microstructure of metals/alloys and thereby on its mechanical properties.

MEU325.3. Evaluate mechanical properties of various materials and compare it with their internal structure to establish structure property co-relation.

MEU326 MACHINE DRAWING LAB

Teaching Scheme: 02 P **Total: 02** **Credits: 01**
Evaluation Scheme: 25 Internal + 25 External **TOTAL MARKS: 50**

Course Objectives:

I. To impart students with the necessary skills for drafting and modelling machine components using CAD tools.
II. To impart the fundamental knowledge in designing and drafting.
III. To develop the Practical knowledge in the field components designing.

It is representative list of practical. The instructor may choose minimum eight Sheet as per his/her requirement (so as to cover entire content of course MEU326) from the list given below

List of Drawing

PART A: Sheets (one each) by using Pro Engineer /CATIA and Sketchbook
1. Sectional Views of objects
2. Developments of surfaces
3. Intersection of solids

PART B: Drawing of following machine elements using Pro/Engineer/CATIA Software (four Sheets)
1. Cotter Joints
2. Knuckle Joints
3. Flange Coupling
4. Wall Bracket
5. Plummer Block
6. Stuffing Box
7. Machine tool Components
8. Rivet and Rivet Joints

PART C: One sheet on: ISI Conventions for various components like bearing, gears, springs, keys and keyways, threads, tap holes and materials

Note:
ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B .
ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of course, the students will be able to:

MEU326.1 Demonstrate the complete methodology of design &drafting.
MEU326.2 Develop skills in designing the automobile engine components using software like Pro Engineer/CATIA etc
MEU326.3 Model and assemble machine parts and Know about the industrial models and their usages in practical design and manufacturing fields.

SHU425 HUMAN VALUE AND ETHICS

Teaching Scheme: 01 L **Total: 01** **Credits: 00**
Evaluation Scheme: 20 TA + 30 ESE **TOTAL MARKS: 50**
Duration of ESE: 1 hrs. 30 min

Course Objectives:

1. To develop the importance of moral virtue through spiritual and yoga activities which leads to professional experience of students.
2. To understand the dimension of professional ethics.
3. To learn engineering ethics through theories which develop moral judgement among technical students.
4. To understand the global ethical issues and its dimension which leads to moral leadership

Human Values

Morals, values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Character, Spirituality, Introduction to yoga and meditation for professional excellence and stress management.

Professional Ethics

Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

Engineering Ethics

Senses of 'Engineering Ethics', Variety of moral issues, Types of inquiry, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Models of professional roles, Theories about right action, Self-interest, Customs and Religion, Uses of Ethical Theories

Global Issues

Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Moral Leadership, Code of Conduct, Corporate Social Responsibility

Text books:

1. "Ethics in Engineering", Mike W. Martin and Roland Schinzinger, Tata McGraw Hill, New Delhi, 2003.
2. "Engineering Ethics", Govindarajan M, Natarajan S, Senthil Kumar V. S, Prentice Hall of India, New Delhi, 2004.

Reference books:

1. "Engineering Ethics", Charles B. Fleddermann, Pearson Prentice Hall, New Jersey, 2004.

3. "Engineering Ethics – Concepts and Cases", Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, Cengage Learning, 2009
4. "Ethics and the Conduct of Business", John R Boatright, Pearson Education, New Delhi,2003
5. "Fundametals of Ethics for Scientists and Engineers", Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford, 2001
6. "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Laura P. Hartman and Joe Desjardins, Mc Graw Hill education, India Pvt. Ltd.,New Delhi
2013.
7. " Value Education", World Community Service Centre, Vethathiri publications, Erode, 2011

Outcomes:
After the successful completion of the course the student shall be able to

1. Make work life balance and found himself or herself with sound mindset at workplace.
2. Incorporate professional ethics at work place.
3. Manage moral dilemmas and conflicts at workplace.
4. Develop global perspective for ethical issues.

MEU421 APPLIED THERMODYNAMICS-I

Teaching Scheme: 04 L **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. To learn about the basic components and their functions in steam power plant
II. To learn about to evaluate heat, work and energy interactions in steam power plant
III. To adopt the most appropriate technique to optimize the performance of individual components in a steam power plant
IV. To develop skill to draw the velocity diagrams of steam turbines

Course Contents:

Steam Power Plant: Steam power cycles, Limitations of Carnot vapour cycle, efficiencies in reheat & regenerative cycle analysis limited to two stages only, typical layout of steam power plant, Concept of co-generation. Elementary simple problems on Steam power cycles

Steam Generators: Indian Boiler Regulations, Classification of Boiler, principle parts and their functions, modern water-tube type steam generator arrangements, Economiser, Superheater, Reheater, Steam Generator Control, Air Preheater, Principle of fluidized bed boiler, Cylone separator. Electrostatic precipitator.

Steam Nozzle: Classification of Nozzle, flow through nozzles, critical pressure ratio and choked flow, nozzle efficiency, determination of throat and exit areas, Concept of super saturated flow and Wilson line.Elementary simple problems on determination of throat and exit areas.

Steam Turbines: Types of steam turbines, Types of steam turbines such as impulse, reaction turbines, Compounding, Velocity diagrams. Graphical and analytical methods for work and power determination, axial thrust and efficiency. Need of Governing, Methods of Turbine governing and control.

Steam Condenser: Functions of a Condenser, Elements of a Condensing Plant, Types of steam condenser, Need of a condenser, Estimation of quantity of cooling water required, condenser and vacuum efficiency. Sources of air in condensers and its effect on performance, Air extraction, Cooling towers.

Energy Conservation in Boilers: Energy conservation options, waste minimization, methodology and economical viability.

Text Books:

1. Basic and Applied Thermodynamics, P.K. Nag, 2nd Edition, Tata Mc-Graw Hill Pub., 2010.
2. Thermal Engineering by Mahesh M Rathore, 3rd Edition, Tata Mc-Graw Hill, 2010

Reference books:

1. Thermodynamics-An Engineering Apporach, Y. A. Cengel and M. A. Boles, 3rd Edition, Mc-Graw Hill, 1998.
2. Applied Thermodynamics, Onkar Singh, 3rd Edition, New Age International Publishing, 2009.

3. Power Plant Engineering, P.K. Nag, 3rd Edition, Tata Mc-Graw Hill Publishing, 2008.

Course Outcomes: After completion of course, the students will be able to:

MEU421.1	Analyze the basic components in steam power plant
MEU421.2	Select the most appropriate method of compounding for steam turbines
MEU421.3	Evaluate and compare the performance of energy conversion devices
MEU421.4	Draw the velocity diagrams of turbine blade.
MEU421.5	Design the steam nozzle as per given parameters

MEU422 FLUID MECHANICS

Teaching Scheme: 04 L **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. To recognize the basic principles and equations of fluid mechanics
II. To distinguish the various types of fluid flow problems encountered in practice
III. To apply laws of mass and momentum conservation for fluid flow system
IV. To analyze the mathematical problem of different fluid flow systems
V. To formulate the equation by using methods of dimensional analysis

Course Contents:

Fluid Statics- Definition of fluid, Newton's law of viscosity, Units and dimensions- Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, pressure at a point in fluid, variation of pressure with depth, fluid application to manometer, vapour pressure, cavitations.

Fluid Kinematics- Types of flow- Methods of describing fluid motion- Velocity and acceleration, Stream line, Streak line, Path line, Stream tube, Stream function, Velocity potential, Flow net- uses, limitations and methods of drawing, Discharge, Control volume- application of continuity equation and momentum equation, Incompressible flow.

Fluid Dynamics- Euler's equation of motion, Bernoulli's equation and its applications, assumption and limitations, Flow measurement, velocity measurement, Energy gradient line and Hydraulic gradient line, Impulse momentum equation, momentum correction factor.

Flow in Channels- Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram, minor losses in pipes and fittings.

Dimensional Analysis– Need, Methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis

Text Books:

1. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som and G. Biswas, 2nd Ed Tata McGraw Hill Education Publishing Company Limited, 2007
2. Fluid mechanics and Hydraulic machines, Dr. R. K. Bansal , 9th Edition, Laxmi Publication, Delhi, 2005

Reference books:

1. Fluid Mechanics Fundamentals and Application, Yunus A. Cengel and John M. Cimbala, 4th Edition, McGraw Hill, 2013
2. Fluid Mechanics, F.M. White, 4th International Editions, McGraw-Hill, 2005
3. Fluid Mechanics, Streeter, 7th Edition, Tata McGraw Hill (SI), 2000

Course Outcomes: After completion of course, the students will be able to:

MEU422.1	Identify the fluid flow system and solve problems involving fluid properties.
MEU422.2	Apply conservation laws to fluid flow problems in engineering applications
MEU422.3	Recognize of laminar and turbulent flow in pipes and the analysis of fully developed flow
MEU422.4	Evaluate the major and minor losses associated with pipe flow in piping networks and determine the pumping power requirements
MEU422.5	Develop the equation by using methods of dimensional analysis

MEU423 MANUFACTURING TECHNOLOGY

Teaching Scheme: 04 L **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. Inculcate the fundamentals of metal cutting and cutting force analysis.
II. Articulate the working principles of lathe, drilling, boring, broaching, reaming, milling, grinding, shaper, planer machine tools.
III. Illustrate the concept of tolerance with design of limits gauges and control charts for attributes and variables
IV. Interpret different concepts of production planning and control

Course Contents:

Metal cutting: Mechanics of metal cutting, Cutting parameters, Tool nomenclature, Orthogonal and oblique cutting, Tool wear and tool life, Chip formation, Cutting tool materials, Cutting fluids, Merchant force circle, Various force components, Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Machine Tools
Lathe: Mechanical Construction, classification of lathe machine, specifications, Operations and accessories of centre lathe, introduction of capstan &turret lathe, introduction to Automatic screw machines.

Drilling: Introduction, Working principle, Classification general purpose, Mass production and special purpose drilling machines, drill tool geometry.
Boring: Gear producing machines, Introduction, classification & mechanical construction og gear producing machines. Horizontal, Vertical and jig Boring machine.
Broaching and Reaming: Introduction, Working principle, classification, mechanical construction.

Milling: Introduction, Working principle, Classification, Types of Milling Cutters, Dividing head, Compound and differential indexing, Climb & conventional milling, applications

Grinding: Introduction, Working principle, Classification, types of bonds & Abrasive, grinding wheel specification, selection of wheel, super finishing processes.Shaper, Planer, Slotter: Introduction, Working principle, mechanical construction, classification

Metrology: Need of inspection; Accuracy, Precision and Errors in measurement; linear and angular measurements; Limits, fits and tolerances; gauge design; comparators; Geometric shapes, Acceptance tests for machine tools

Statistical Quality Control: Basic statistical concepts; frequency distribution, Control charts for Attributes and Variables; Acceptance Sampling

Production planning& control: Principles of production planning and control, Types of production, Sales forecasting, Economic batch quantity, PPC functions, PPC for different types of production, Inventory control: functions, objectives, Selective Inventory control, Inventory Management Systems, Economic Order Quantity (EOQ)

Text Books:

1. Workshop TechnologyVol II, B S Raghuwanshi, 10th Edition Dhanpat Rai & Sons, Delhi

2. Statistical Quality Control, M. Mahajan, Dhanpat Rai & Co.(P) Ltd
3. A Textbook of Production Engineering, P C Sharma, S. Chand & Company Ltd

Reference books:

1. Manufacturing Technology Volume II 4th Edition, P. N. Rao, McGraw Hill
2. Workshop Technology Vol II, H S Bawa, 2ndEdition, Tata Mc Graw Hill

Course Outcomes: After completion of course, the students will be able to:

MEU423.1	Explain working principles and classify lathe, drilling, boring, broaching, reaming, milling, grinding, shaper, planer and slotter operations.
MEU423.2	Differentiate and compare machining processes in terms of application, function, advantages, disadvantages, quality and productivity
MEU423.3	Calculate design tolerances using hole and shaft basis systems and Construct control charts for attributes and variables
MEU423.4	Articulate the concepts of production planning and control as per requirement

CEU430 STRENGTH OF MATERIAL

Teaching Scheme: 04 L **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **TOTAL MARKS: 100**
Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. To establish an understanding of fundamental concepts of stresses, strains and response of elastic solid to external loadings.
II. To provide the knowledge principles, theorems required for analysis and design of various types of structural members subjected to axial, transverse shear, bending and tortional loadings.
III. To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics
IV. To built the necessary theoretical background for further structural analysis and design courses.

Course Contents:

Simple Stresses and Strain: Concept of stress and strain, St. Venants principle, types of stresses and strains, Hooke's law, stress-strain diagram for mild steel and brittle material. Working stress, factor of safety, lateral strain, poissons ratio and volumetric strain. Elastic constants and relationship among them. Bars of varying section – composite bar of two materials only-temperature stresses. Strain energy-Resilience-Gradual, sudden, Impact and shock loading and their applications.

Principal Stresses and Principal Planes: General two dimensional stress system. Stress at a point on a plane, principal stresses and principal planes. Mohr's circle of stress, concept of ellipse of stress and its use. Principal strains and circle of strain.

Shear Force (S.F.) and Bending Moment (B.M.) Diagrams For Determinate Beams: S.F. and B.M. diagrams for cantilever, simply simply supported beams with and without overhangs. Calculation of maximum B.M. and S.F. and location of point of contra flexure due to concentrated load, uniformly distributed loads and uniformly varying loads and moments. Relation among shear force, bending moment and loading intensity.

Stresses in Beams (Flexural and Shear): (i) Flexural or bending stresses: Theory of simple bending – Assumption- Derivation of bending equation $M/I = F/Y = E/R$ Section modulus of rectangular and circular section (Solid and Hollow). Moment of resistance. Bending stress in solid, hollow and built up sections. Design of simple beam section. **(ii)** Shearing Stresses: Derivation for shear stress in beam, shear stress distribution across various beam sections like rectangular, circular and built up sections.

Torsion: (i) Derivation of equation and its assumptions. Polar modulus Application of equation to hollow and solid circular shaft, tortional, circular shaft subjected to combined bending and torsion. **(ii)** Thin cylinders and Spheres Derivation for circumferential stress and longitudinal stress. Calculation of circumferential and longitudinal stresses in a cylinder of thin sphere subjected to internal pressure.

Slope and Deflection of Determinate Beam: Relation between moment, slope and deflection, derivation of moment area theorems. Slope and deflection of statically determinate beams subjected to concentrated loads and uniformly distributed load by Macaulay's Method and Moment area method.(Numerical Examples) Concept of Conjugate Beam method (No numerical examples)

Combined Direct and Bending Stresses: Combined direct and bending stresses, applications to short columns with eccentric loads.

Text Books:

1. Mechanics of Materials, Beer and Johnston, Tata McGraw Hill Publication
2. Mechanics of Structures- vol-I, S.B. Junnarkar, Charotar publication house, 32 th Edition 2016
3. Strength of Materials, R.Subramanian, Oxford University Press, 2007

Reference Books:

1. Mechanics of Materials, Gere and Timoshenko, CBS Publishers
2. Engineering Mechanics of Solids, E.P. Popov, 2nd Edition, Prentice Hall India,1998
3. Strength of Materials, G.H. Ryder, Prentice Hall Publications, 3rd Edition, 2002.

Course Outcomes: After completion of course, the students will be able to:

CEU430.1	Understand basic concepts of stress-strain, and evaluate behavior and other physical properties of elastic isotropic materials.
CEU430.2	Determine the internal forces in structural elements under different types of loadings (axial, transverse shear, bending, tortional) and draw their graphical representation.
CEU430.3	Apply the concept of principal stresses and strains for analysis of structural element.
CEU430.4	Calculate the deflection at any point on a determinant beam subjected to combination of loads.

SHU422 ENVIRONMENTAL ~~SCIENCE~~ Studies

Teaching Scheme: 01 L **Total: 01** **Credits: 00**
Evaluation Scheme: 20TA+30 ESE **TOTAL MARKS: 50**
Duration of ESE: 1 hrs. 30 min

Course objectives: The objectives of offering this course are to-

- Be aware of various environmental factors and there preservation.
- Teach them how to protect Environment and natural resources.
- How to make equitable use of energy resources

Course contents:

The Multidisciplinary Nature of Environmental Studies:- Definition, scope and importance, Need for public awareness.

Social issues and Environment:- From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rainwater harvesting, and watershed management Resettlement and rehabilitation of people, problems.

Environmental ethics:- Issues and possible solution, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation. Consumerism and Waste products, Environment protection act, Air (prevention & control) act, Water (prevention and control) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation.

Human population and environment:- Environment and human health, Human rights, Role of Information Technology in Environment and human health, Public awareness.

Natural Recourses:- Conventional energy resources: definition, classification, composition, energy content types: coal, petroleum, natural gases, hydrogeothermal, nuclear, environmental implication of energy uses. Non conventional energy resources: solar energy, wind energy, tidal energy, geothermal energy, hydropowers and biogas.

Ecosystem and Biodiversity:-Concept of ecosystem, Structure and function of ecosystem, Producer, consumer, decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystem: Forest ecosystem, Grass land ecosystem, Desert ecosystem Aquatic ecosystem (Rivers and ocean).

Introduction- definition: genetics, species and ecosystem, diversity. Biogeographically classification of India. Conservation of biodiversity- In-situ and Ex-situ conservation of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as mega diversity nation. Hot spot of biodiversity.

Environmental Pollution:- Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste, Management, Causes effects and control measures, Role of individual in prevention of pollution, Hazardous waste management, Biomedical waste management, Disaster management: floods, earthquake, cyclone and landslides.

Course outcomes:

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

- Convey the Environmental awareness among peoples.
- Apply Conservation of various natural resources and environmental factors.
- Aware about social and environmental issues.

Recommended Books:

1) The Biodiversity of India, Bharucha Erach ,Marin Publishing Pvt. Ltd., Ahmedabad
2) Brunner R.C., 1989,Hazardous Waste Incineration, McGraw Hill Inc.
3) Marine pollution, Clark R.S., Clanderson Press Oxford (TB)
4) Environmental Chemistry, De A.K. Wiley Estern Lmt.
5) Environmental Chemistry, Sharma B.K., 2001 Goel Publ., House, Meerat.
6) Environmental Management, Wagner K.D., 1998, W.B. Saunders Co., Philadel phia, USA
7) Environmental Studies, Benny Joseph, 1st edition,2005,Tata Mcgraw-Hill Publ.

MEU424 FLUID MECHANICS LAB

Teaching Scheme: 02 P **Total: 02** **Credits: 01**
Evaluation Scheme: 25 Internal + 25 External **TOTAL MARKS: 50**

Course Objectives:

I. To validate the various theory concept practically by demonstrating the experiments
II. To acquire hand on experience to use the various measuring instrument for the fluid flow
III. To analyze the various frictional losses in fluid flow
IV. To develop the practically evaluating ability in the different situation of fluid flow
V. To utilize this practical knowledge for upcoming related subject and research work

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It is representative list of practical. The instructor may choose minimum eight experiments as per his/her requirement (so as to cover entire content of course MEU424) from the list given below:

List of Practical

1. Measurement of fluid pressure
2. Verification of Bernoulli's equation
3. Determination of Reynolds number
4. Determination of co-efficient of friction for pipes
5. Determination of Coefficient of Discharge of given Venturi meters
6. Determination of Coefficient of Discharge of given Orifice meters
7. Determination of the density and friction factor of oil flow in a pipe
8. Analysis of velocity distribution in Boundary layer and its thickness
9. Determination of head loss due to sudden enlargement and contraction
10. Determination of losses in bends and elbows
11. Analysis of flow through pipes in series and parallel

Note:
ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B
ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of course, the students will be able to:

MEU424.1	Measure various properties of fluids
MEU424.2	Characterize the performance of fluid systems
MEU424.3	Analyze the various frictional losses in fluid flow
MEU424.4	Identify the types of flow by using flow demonstrator
MEU424.5	Develop the experimental set-up and analyze for performance

CEU431 STRENGTH PF MATERIAL LAB

Teaching Scheme: 02 P **Total: 02** **Credits: 01**
Evaluation Scheme: 25 Internal + 25 External **TOTAL MARKS: 50**

Course Objectives:

I. To study the mechanical properties of materials when subjected to different types of loading.
II. To verify the principals studied in solid mechanics theory by performing experiments in laboratory.

It is a representative list of practicals. The instructor may choose experiment as per his/her requirements (so as to cover entire contents f the course CEU425) from the list or otherwise. Minimum eight experiments should be performed.

List of Practical

1. Tension test on mild steel or TOR steel.
2. Hardness tests (Brinell and Rockwell) on mild steel, copper, aluminum, brass and cast iron.
3. Impact test on mild steel, aluminum, copper, brass, cast iron.
4. Shear test on mild steel and aluminum.
5. Torsion test on mild steel and cast iron.
6. Fatigue test on mild steel.
7. Measurement of deflection in statically determinate beam.
8. Flexure test on wooden beam.
9. Determination of stiffness and modulus of rigidity of spring.
10. Compression test on wood (parallel and perpendicular to gins)
11. Strain measurement using Rossette strain guage
12. Compression test on metals.

Note:
ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B
ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of course, the students will be able to:

CEU431.1. Performs, tension, shear, torsion and compression tests on solid materials.
CEU431.2. Determine the toughness of the material using Charpy and Izod test.
CEU431.3. Determine the Brinell and Rockwell hardness number of given metal specimen.
CEU431.4. Estimate the elastic constants through compression test on spring and deflection test on beams