Department of Mechanical Engineering

GEETANJALIINSTITUTEOFTECHNICALSTUDIES, UDAIPUR

तमसो मा ज्योतिर्गमय्

Darkness to Light

COURSE DESCRIPTION

BACHELOR OF TECHNOLOGY

Academic Session 2020-21

Rajasthan Technical University, Akelgarh, Kota, Rajasthan32401

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Vision of Department of Mechanical Engineering

To impart comprehensive knowledge that enables the students to become innovative and successful entrepreneur to learn the advanced fields of mechanical engineering that meets the recent industrial demands and social needs.

Mission of Department of Mechanical Engineering

M1: To provide quality education to the students which will enhance their skills and ability to create, innovate and design systems based on new technologies for the society.

M2: To foster logical thinking among the students to design system required for real-life situation.

M3: To equip the students through the state-of-art learning environment that can provide academic environment of excellence, entrepreneurship and moral guidelines with lifelong learning

Programme Educational Objectives (PEOs)

PEO1	*Prepare students to be proficient mechanical engineer and also to pursue higher studies*
PEO2	*Strengthening the foundation of analytical and scientific thinking to handle technical challenges of the country.*
PEO3	*Encourage students to design innovative products/solutions independently for technical requirements.*
PEO4	*Inculcate professional and ethical attitude, effective communication skills, team spirit, work abilities and multidisciplinary approach to amend technical barriers of nation.*
PEO5	*To develop critical & out of box thinking & develop aptitude for research and development to lead a successful professional career*

Programme Outcomes (POs)

1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, research literature and analyze complexengineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesofmathematics,natural sciences and engineering sciences.
3. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
4. **Conduct investigations:** of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities

with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of 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.

PSO's (Program Specific Outcomes)

PSO1: Graduate will be able to demonstrate the operation of the physical systems, components and process involved in mechanical engineering.

PSO2: Graduate will be able to do work on multi-disciplinary projects.

PSO3: Graduate will be able to design, simulate and analyze mechanical devices that might help in solving technical problems

SCHEME OF TEACHING AND EXAMINATION

Teaching and Examination
Scheme1st Semester:B.Tech
Common to all branches of UG Engineering & Technology

SN	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	BSC	1FY2-01	Engineering Mathematics-I	3	1	-	40	160	**200**	**4**
2	BSC	1FY2-02/ 1FY2-03	Engineering Physics/Engineering Chemistry	3	1	-	40	160	**200**	**4**
3	HSMC	1FY1-04/ 1FY1-05	Communication Skills/Human Values	2	-	-	20	80	**100**	**2**
4	ESC	1FY3-06/ 1FY3-07	Programming for Problem Solving/Basic Mechanical Engineering	2	-	-	20	80	**100**	**2**
5	ESC	1FY3-08/ 1FY3-09	Basic Electrical Engineering/Basic Civil Engineering	2	-	-	20	80	**100**	**2**
6	BSC	1FY2-20/ 1FY2-21	Engineering Physics Lab/ Engineering Chemistry Lab	-	-	2	30	20	**50**	**1**
7	HSMC	1FY1-22/ 1FY1-23	Language Lab/Human Values Activities and Sports	-	-	2	30	20	**50**	**1**
8	ESC	1FY3-24/ 1FY3-25	Computer Programming Lab/ Manufacturing Practices Workshop	-	-	3	45	30	**75**	**1.5**
9	ESC	1FY3-26/ 1FY3-27	Basic Electrical Engineering Lab/ Basic Civil Engineering Lab	-	-	2	30	20	**50**	**1**
10	ESC	1FY3-28/ 1FY3-29	Computer Aided Engineering Graphics/Computer Aided Machine Drawing	-	-	3	45	30	**75**	**1.5**
11	SODECA	1FY8-00							**25**	**0.5**
Total									**1025**	**20.5**

L=Lecture, **T**=Tutorial P=Practical , **IA**=Internal Assessment**, ETE**=End Term Exam,

Cr=Credit

2nd Semester: B.Tech.

Common to all branches of UG Engineering & Technology

SN	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	BSC	2FY2-01	Engineering Mathematics-II	3	1	-	40	160	**200**	**4**
2	BSC	2FY2-03/ 2FY2-02	Engineering Chemistry/ Engineering Physics	3	1	-	40	160	**200**	**4**
3	HSMC	2FY1-05/ 2FY1-04	Human Values/ Communication Skills	2	-	-	20	80	**100**	**2**
4	ESC	2FY3-07/ 2FY3-06	Basic Mechanical Engineering/Programming for Problem Solving	2	-	-	20	80	**100**	**2**
5	ESC	2FY3-09/ 2FY3-08	Basic Civil Engineering/Basic Electrical Engineering	2	-	-	20	80	**100**	**2**
6	BSC	2FY2-21/ 2FY2-20	Engineering Chemistry Lab/Engineering Physics Lab	-	-	2	30	20	**50**	**1**
7	HSMC	2FY1-23/ 2FY1-22	Human Values Activities and Sports/ Language Lab	-	-	2	30	20	**50**	**1**
8	ESC	2FY3-25/ 2FY3-24	Manufacturing Practices Workshop/ Computer Programming Lab	-	-	3	45	30	**75**	**1.5**
9	ESC	2FY3-27/ 2FY3-26	Basic Civil Engineering Lab/Basic Electrical Engineering Lab	-	-	2	30	20	**50**	**1**
10	ESC	2FY3-29/ 2FY3-28	Computer Aided Machine Drawing/ Computer Aided Engineering Graphics	-	-	3	45	30	**75**	**1.5**
11	SODE CA	1FY8-00							**25**	**0.5**
Total									**1025**	**20.5**

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Cr=Credits

2nd Year 3rd Semester

B.Tech.: Mechanical Engineering

SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs	IA	ETE	Total	
THEORY											
1	BSC	3ME2-01	Advance Engineering Mathematics-I	3	0	0	3	30	120	**150**	**3**
2	HSMC	3ME1-02/ 3ME1-03	Technical Communication/Managerial Economics and Financial Accounting	2	0	0	2	20	80	**100**	**2**
3	ESC	3ME3-04	Engineering Mechanics	2	0	0	2	20	80	**100**	**2**
4	PCC	3ME4-05	Engineering Thermodynamics	3	0	0	3	30	120	**150**	**3**
5		3ME4-06	Materials Science and Engineering	3	0	0	3	30	120	**150**	**3**
6		3ME4-07	Mechanics of Solids	3	1	0	3	40	160	**200**	**4**
			Sub Total	16	1	0		170	680	**850**	**17**
PRACTICAL&SESSIONAL											
7	PCC	3ME4-21	Machine drawing practice	0	0	3		45	30	**75**	**1.5**
8		3ME4-22	Materials Testing Lab	0	0	3		45	30	**75**	**1.5**
9		3ME4-23	Basic Mechanical Engineering Lab	0	0	3		45	30	**75**	**1.5**
10		3ME4-24	Programming using MATLAB	0	0	3		45	30	**75**	**1.5**
11	PSIT	3ME7-30	Industrial Training	0	0	1		0	0	**50**	**1**
12	SODECA	3ME8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0		0	0	**25**	**0.5**
			Sub-Total	0	0	13		180	120	**375**	**7.5**
		TOTALOFIIISEMESTER		16	1	13		350	800	**1225**	**24.5**

L:Lecture, **T:**Tutorial, **P:**Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

2nd Year 4th Semester

B.Tech.: Mechanical Engineering

THEORY											
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	BSC	4ME2-01	Data analytics	2	0	0	2	20	80	**100**	**2**
2	HSMC	4ME1-03/ 4ME1-02	Managerial Economics and Financial Accounting/Technical Communications	2	0	0	2	20	80	**100**	**2**
3	ESC	4ME3-04	Digital Electronics	2	0	0	2	20	80	**100**	**2**
4	PCC	4ME4-05	Fluid Mechanics and Fluid Machines	3	1	0	3	40	160	**200**	**4**
5		4ME4-06	Manufacturing Processes	3	0	0	3	30	120	**150**	**3**
6		4ME4-07	Theory of machines	3	1	0	3	40	160	**200**	**4**
			Sub Total	15	2	0		170	680	**850**	**17**
PRACTICAL&SESSIONAL											
7	PCC	4ME3-21	Digital Electronics lab	0	0	3		45	30	**75**	**1.5**
8		4ME4-22	Fluid Mechanics lab	0	0	3		45	30	**75**	**1.5**
9		4ME4-23	Production practice lab	0	0	3		45	30	**75**	**1.5**
10		4ME4-24	Theory of machines Lab	0	0	3		45	30	**75**	**1.5**
11	SODECA	4ME8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0		0	0	**25**	**0.5**
			Sub-Total	0	0	12		180	120	**325**	**6.5**
		TOTAL OF IV SEMESTER		15	2	12		350	800	**1175**	**23.5**

L: Lecture, **T:**Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

3rdYear 5thSemester

B.Tech.: Mechanical Engineering

THEORY											
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	ESC	5ME3-01	Mechatronic Systems	2	0	0	2	20	80	**100**	**2**
2	PCC/PEC	5ME4-02	Heat Transfer	3	0	0	3	30	120	**150**	**3**
3		5ME4-03	Manufacturing Technology	3	0	0	3	30	120	**150**	**3**
4		5ME4-04	Design of Machine Elements I	3	0	0	3	30	120	**150**	**3**
5		5ME4-05	Principles of Management	2	0	0	2	20	80	**100**	**2**
6		Professional Elective I(anyone)		3	0	0	3	30	120	**150**	**3**
		5ME5-11	Steam Engineering								
		5ME5-12	Automobile Engineering								
		5ME5-13	Non Destructive Evaluation &Testing								
		Sub Total		**16**	**0**	**0**		**160**	**640**	**800**	**16**
PRACTICAL&SESSIONAL											
7	ESC	5ME3-21	Mechatronic Lab	0	0	2	2	30	20	**50**	**1**
8	PCC	5ME4-22	Heat Transfer lab	0	0	2	2	30	20	**50**	**1**
9		5ME4-23	Production Engineering Lab	0	0	2	2	30	20	**50**	**1**
10		5ME4-24	Machine Design Practice I	0	0	2	2	30	20	**50**	**1**
11	PSIT	5ME7-30	Industrial Training	0	0	1	1	75	50	**125**	**2.5**
12	SODECA	5ME8-00	Social Outreach, Discipline & Extra Curricular Activities						25	**25**	**0.5**
		Sub-Total		**0**	**0**	**9**		**195**	**155**	**350**	**7**
		TOTALOFV SEMESTER		**16**	**0**	**9**		**355**	**795**	**1150**	**23**

L:*Lecture,* ***T:****Tutorial,* ***P:****Practical,* ***Cr:*** *Credits*

ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

3rdYear 6thSemester

B.Tech.: Mechanical Engineering

THEORY											
SN	**Category**	**Course**		**Contact hrs/week**			**Marks**				**Cr**
		Code	**Title**	**L**	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	ESC	6ME3-01	Measurement and Metrology	2	0	0	2	20	80	**100**	**2**
2	PCC/ PEC	6ME4-02	CIMS	3	0	0	3	30	120	**150**	**3**
3		6ME4-03	Mechanical Vibrations	3	0	0	3	30	120	**150**	**3**
4		6ME4-04	Design of Machine Elements II	3	0	0	3	30	120	**150**	**3**
5		6ME4-05	Quality Management	3	0	0	3	30	120	**150**	**3**
6		Professional Elective II(anyone)		3	0	0	3	30	120	**150**	**3**
		6ME5-11	Refrigeration and Air Conditioning								
		6ME5-12	NON Conventional Machining Methods								
		6ME5-13	MEMS and Microsystems								
		Sub Total		**17**	**0**	**0**		**170**	**680**	**850**	**17**
PRACTICAL&SESSIONAL											
7	PCC	6ME4-21	CIMS Lab	0	0	3	3	45	30	**75**	**1.5**
8		6ME4-22	Vibration Lab	0	0	3	3	45	30	**75**	**1.5**
9		6ME4-23	Machine Design Practice II	0	0	3	3	45	30	**75**	**1.5**
10		6ME4-24	Thermal Engineering Lab I	0	0	3	3	45	30	**75**	**1.5**
11	SODECA	6ME8-00	Social Outreach, Discipline & Extra Curricular Activities						25	**25**	**0.5**
		Sub-Total		**0**	**0**	**12**		**180**	**145**	**325**	**6.5**
		TOTALOFVISEMESTER		**17**	**0**	**12**		**350**	**825**	**1175**	**23.5**

L: Lecture, **T:**Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

4th Year 7th Semester

B.Tech.: Mechanical Engineering

	THEORY										
SN	**Category**	**Course Code**	**Course Title**	**Hours Per Week**			**Marks**				**Cr**
				L	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	PCC	7ME5	11 I. C. Engines	3	0	0	3	30	120	**150**	**3**
2	OE		Open Elective-I (NDT)	3	0	0	3	30	120	**150**	**3**
		Sub Total		**6**	**0**	**0**		**60**	**240**	**300**	**6**
PRACTICAL& SESSIONAL											
3	PCC	7ME4-21	FEA Lab	0	0	3	3	45	30	**75**	**1.5**
4		7ME4-22	Thermal Engineering Lab II	0	0	3	3	45	30	**75**	**1.5**
5		7ME4-23	Quality Control Lab	0	0	2	2	30	20	**50**	**1**
7	PSIT	7ME7-30	Industrial Training *	1	0	0	1	75	50	**125**	**2.5**
8		7ME7-40	Seminar *	2	0	0	2	60	40	**100**	**2**
9	SODECA	7ME8-00	SODECA	0	0	0		0	25	**25**	**0.5**
		Sub-Total		**3**	**0**	**8**		**255**	**195**	**450**	**9**
		TOTALOFVIISEMESTER		**9**	**0**	**8**		**315**	**435**	**750**	**15**

L: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

4th Year 8th Semester

B.Tech.: Mechanical Engineering

	THEORY										
SN	**Category**	**Course Code**	**Course Title**	**Hours Per Week**			**Marks**				**Cr**
				L	**T**	**P**	**Exam Hrs**	**IA**	**ETE**	**Total**	
1	PEC	8ME5-12	Supply and Operations Management	3	0	0	3	30	120	**150**	**3**
2	OE		Open Elective-II (Maintenance Management)	3	0	0	3	30	120	**150**	**3**
		Sub Total		**6**	**0**	**0**	6	**60**	**240**	**300**	**6**
PRACTICAL&SESSIONAL											
3	PCC	8ME4-21	Industrial Engineering Lab	0	0	2	2	30	20	**50**	**1**
4		8ME4-22	Metrology Lab	0	0	2	2	30	20	**50**	**1**
5	PSIT	8CE7-50	Project	3	0	0	3	210	140	**350**	**7**
6	SODECA	8CE8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0		0	25	**25**	**0.5**
		Sub-Total		**3**	**0**	**4**		**270**	**205**	**475**	**9.5**
		TOTAL OF VIII SEMESTER		**9**	**0**	**4**		**330**	**445**	**775**	**15.5**

L: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA :** Internal Assessment

Detailed Syllabus

1FY2-01: ENGINEERING MATHEMATICS-I

Credit: 4 **Max. Marks: 200(IA: 40, ETE: 160)**

3L+1T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO11201.1	Learner will be skilled to estimate volume and surface area of the solid formed by revolution of different curves. Also workout definite integral through Beta and Gamma functions.
CO11201.2	Students will be familiar with the concept of sequence, monotonic sequence, Cauchy's sequence and infinite series. Also work out various method to test convergence and divergence of sequence and infinite series
CO11201.3	Learner will be competent to express a function in term of a series of sine and cosine.
CO11201.4	Students will be able to estimate maxima and minima of multivariable functions using the concept of partial differentiation. Further workout limit, continuity and differentiability of two variable functions.
CO11201.5	Learner will be skilled in the technique to evaluate double and triple integration and able to apply the knowledge to determine area, volume, centre of mass and centre of gravity. Further work out vector differentiation and vector integration.

UNIT	Syllabus
UNIT 1	Calculus: Improper integrals (Beta and Gamma functions) and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.
UNIT 2	Sequences and Series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.
UNIT 3	Fourier Series: Periodic functions, Fourier series, Euler's formula, Change of intervals, Half range sine and cosine series, Parseval's theorem.
UNIT 4	Multivariable Calculus (Differentiation): Limit continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.
UNIT 5	Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities); Triple integrals(Cartesian), Simple applications involving cubes, sphere and rectangular parallelepipeds ; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Text Books	
1	Thomas' Calculus, George B. Thomas, Jr., Maurice D. Weir, Joe lR. Hass, Pearson Educations
2	Calculus with Early Transcendental Functions, James Stewart, Cengage Lerning Publication.
3	Engineering Mathematics, C. B. Gupta, S. R. Singh and Mukesh Kumar, McGraw Hill Education
4	Engineering Mathematics, S. Paland S. C. Bhunia, Oxford University Press.
5	Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education.

1FY2-02/2FY2-02: ENGINEERING PHYSICS

Credit:4 **Max. Marks: 200 (IA: 40, ETE: 160)**
3L+1T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO12201.1	Understand the concept of interference and diffraction to explain various wave optical phenomena
CO12201.2	To develop the concept of quantum mechanics and apply the knowledge to1D and3Dpotential box problem
CO12201.3	Understand the concept of coherence in source of light and basics of an optical fiber: working principle and construction, NA and acceptance angle of an Optical Fiber
CO12201.4	Understand the working of a LASER and basics of material science & characterization of materials
CO12201.5	Understanding Electromagnetism with the help of Maxwell's equation and formulate the electromagnetic energy transformation theorem

UNIT	Syllabus
UNIT 1	Wave Optics: Newton‟s Rings, Michelson‟s Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg‟sLaw.
UNIT 2	Quantum Mechanics: Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrödinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrödinger's Equation: Particle in one dimensional and three dimensional boxes.
UNIT 3	Coherence and Optical Fibers: Spatial and temporal coherence: Coherence length; Coherence time and Q factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.
UNIT 4	Laser: Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.
UNIT 5	Material Science & Semiconductor Physics: Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermidirac distribution function and Fermienergy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications**.**
	Introduction to Electromagnetism: Divergence and curl of electrostatic field, Laplace's and Poisson's equations for electrostatic potential, Bio-Savart law, Divergence and curl of static magnetic field, Faraday's law, Displacement current and magnetic field arising from time dependent electric field, Maxwell's equations, Flow of energy and Pointing vector.

Text Books	
1	Engineering Physics: Malik and Singh (Tata McGraw Hill)
2	Engineering Physics: Naidu (Pearson)
3	Optics: Ajay Ghatak (Tata McGraw Hill)
4	Concept to Modern Physics : A. Baiser (Tata McGraw Hill)
5	Fundamental of Optics : Jetkins and White (Tata McGraw Hill)

1FY2-03/2FY2-03: ENGINEERING CHEMISTRY

Credit:4 **Max. Marks: 200 (IA: 40, ETE : 160)**

3L+1T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO11203.1	Differentiation between hard and soft water, solve the related numerical problems on water treatment; and its application in industries and daily life
CO11203.2	Comprehension of various types of fuel, instrumental techniques for analysis and solve the numerical problems related to it
CO11203.3	Identification of corrosion and application of its knowledge to protect the metal
CO11203.4	Developing basic knowledge of Inorganic Engineering materials viz. cement, glass, lubricants
CO11203.5	Basic knowledge of organic reaction mechanism and introduction of drugs

UNIT	Syllabus
UNIT 1	Water: Common impurities, hardness, determination of hardness by complex metric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Waters oftening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.
UNIT 2	Organic Fuels: Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann by-product oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter, Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.
UNIT 3	Corrosion and its control: Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial lanode and modifications in design
UNIT 4	Annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.
UNIT 5	Organic reaction mechanism and introduction of drugs: Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic additioninal dehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Text Books	
1	Engineering Chemistry by Monica Jain and PC Jain, Dhanpat Rai Publishing Company
2	Engineering Chemistry Wiley, India.
3	The Chemistry and Technology of Coal, by JG Speigh, CRC Press.
4	The Chemistry and Technology of Petroleum, by J G Speigh, CRC Press

1FY1-04/2FY1-04: COMMUNICATION SKILLS

Credit:2 **Max. Marks: 100 (IA: 20, ETE: 80)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO11104.1& CO12104.1	Students will be able to understand and develop communication skills and techniques which will felicitate their ability to work collaboratively with others
CO11104.2 & CO12104.2	Students will be able to use English grammar accurately that will increase their confidence in English writing and speaking
CO11104.3 & CO12104.3	Students will be able to invent, draft, organize, abstract, elaborate and synthesize their own and other's ideas in formatted way
CO11104.4 & CO12104.4	Students will be able to understand literary devices after reading stories and also learn about parts of speech and vocabulary
CO11104.5 & CO12104.5	Students will be able to understand literary devices and figure of speech after reading poems and also appreciate art in all forms

UNIT	Syllabus
UNIT 1	Communication: Meaning, Importance and Cycle of Communication. Media and Types of Communication. Verbal and Non-Verbal communication. Barriers to communication. Formal and Informal Channels of Communication (Corporate Communication). Divisions of Human Communication and Methods to improve Interpersonal Communication. Qualities of good communication
UNIT 2	Grammar: Passive Voice. Reported Speech. Conditional Sentences. Modal Verbs. Linking Words (Conjunctions)
UNIT 3	Composition: Job Application and Curriculum Vitae Writing Business Letter Writing paragraph writing. Report Writing
UNIT 4	Short Stories: “Luncheon” by Somerset Maugham. “How Much Land Does a Man Need?” by Count Leo Tolstoy. “The Night Train at Deoli” by Ruskin Bond.
UNIT 5	Poems:“No Men are Foreign” by James Kirkup. “If” by Rudyard Kipling. “Where the Mindis without Fear” by Rabindra NathTagore.

Text Books	
1	Communication Skills, Pushplata & Sanjay Kumar, Oxford University Press, India.
2	The Written Word, Vandana Singh, Oxford University Press, India.
3	Current English Grammar and Usage with Composition, R.P.Sinha, Oxford University Press, India.
4	Rodriques M.V., ‘Effective Business Communication’, Concept Publishing Company, NewDelhi,1992 reprint (2000).
5	Bansal, RK and Harrison JB, ‘Spoken English ’Orient Longman, Hyderabad.

1FY1-05/2FY1-05: HUMAN VALUES

Credit:2 **Max. Marks: 100 (IA: 20, ETE: 80)**
2L+0T+0P **End Term Exam : 2 Hours**

Course outcome	Details
CO11105.1 & CO12105.1	Students will understand the importance of Happiness through Identification of Human Values and Skills**.**
CO11105.2 & CO12105.1	Students will understand the role of basic human aspirations in self and people around them.
CO11105.3 & CO12105.1	Students will understand about the harmony in family, in society and practically understand the importance of trust and respect as foundational value of relationship
CO11105.4 & CO12105.1	Students will understand the interconnectedness among the four orders of nature, recyclability, coexistence and harmony at all level of existence
CO11105.5 & CO12105.1	Students will understand to be prepared for humanistic education, professional competence with ethics and humanistic universal order.

UNITS	SYLLABUS
UNIT 1	Need, Basic Guidelines, Contentand Process for Value Education Understanding the need, basic guidelines, Self Exploration - its content and process; „NaturalAcceptance"andExperientialValidation,ContinuousHappinessandProsperity-HumanAspirations, Right understanding, Relationship and Physical Facilities, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels
UNIT 2	Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient I and the material Body Understanding the needs of Self (I) and Body - Sukh and Suvidha Understanding the Body as an instrument of I Understanding the characteristics and activities of I and harmony in I Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyamand Swasthya.
UNIT 3	Understanding Harmony in the Family and Society-Harmony in Human-Human Relationship Understanding harmony in the Family, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society, Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals,Visualizing a universal harmonious order in society-Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family.
UNIT 4	Understanding Harmony in the Nature and Existence-Whole existence as Coexistence Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all pervasive Space. Holistic perception of harmony at all levels of existence

UNIT 5	Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, (b) Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, technologies and management models. Strategy for transition from the present state to Universal Human Order: (a). at the level of individual: as socially and ecologically responsible engineers, technologists and managers.(b).at the level of society: as mutually enriching institutions and organization. Case studies related to values in professional life and individual life.

Text Books	
1	R R Gaur, R Sangal, GP Bagaria, A Foundation Course in Human Values and Professional Ethics
2	IvanIllich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

1FY3-06/ 2FY3-06: PROGRAMMING FOR PROBLEM SOLVING

Credit: 2 **Max. Marks: 100 (IA: 20, ETE: 80)**
2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO11306.1	To get the basic knowledge of computer & problem solving through algorithms &flowchart
CO11306.2	To translate the algorithms to programs & execution (in C language)
CO11306.3	To implements conditional branching, iteration
CO11306.4	To decompose a problem into functions and to develop modular reusable code
CO11306.5	To use arrays, pointers and structures to develop algorithms and programs

UNIT	Syllabus
UNIT 1	Fundamentals of Computer: Stored program architecture of computers, Storage device- Primary memory, and Secondary storage, Random, Direct, Sequential access methods, Concepts of High- level, Assembly and Low-level languages, Representing algorithms through flowchart and pseudo code.
UNIT 2	Number system: Data representations, Concepts of radix and representation of numbers in radix r with special cases of r=2, 8, 10 and 16 with conversion from radix r1 to r2, r‟s and (r-1)‟s complement, Binary addition, Binary subtraction, Representation of alphabets.
UNIT 3	C Programming: Problem specification, flow chart, data types, assignment statements, input output statements, developing simple C programs, If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement, development of C programs using above statements, Arrays, functions, parameter passing, recursion, Programming in C using these statements, Structures, files, pointers and multi file handling.

Text Books	
1	Fundamental of Computers By R. Thareja**,** Oxford University Press.
2	Programming in ANSI C by E Balagurusamy, Tata McGraw-Hill Education.
3	Fundamental of Computers By R. Thareja**,** Oxford University Press.
4	Programming in ANSI C by E Balagurusamy, Tata McGraw-Hill Education.
5	The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, PHI.

1FY3-07/ 2FY3-07: BASIC MECHANICAL ENGINEERING

Credit: 2 **Max. Marks: 100 (IA: 20, ETE: 80)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO11307.1 & CO12307.1	Students will be able to understand the introduction of mechanical engineering and develop knowledge about steam boilers, steam turbines and power plants**.**
CO11307.2 & CO12307.2	Students will be able to conclude basics of centrifugal, reciprocation pumps and Internal Combustion Engine. Students will be able to create knowledge of various types of refrigeration and air conditioning systems with their applications.
CO11307.3 & CO12307.3	Students will be able to analyze basics of different type's Power transmission systems such as belt, rope, gears and gear trains
CO11307.4 & CO12307.4	Students will be able to illustrate working of different manufacturing processes
CO11307.5 & CO12307.5	Students will be able to identify different engineering materials there, properties and various types of heat treatment processes

UNIT	Syllabus
UNIT 1	Fundamentals: Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers classification and types of steam boilers and steam turbines. Introduction and Classification of power plants
UNIT 2	Pumps and IC Engines: Applications and working of Reciprocating and Centrifugal pumps. Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components
UNIT 3	Refrigeration and Air Conditioning: Introduction, classification and types of refrigeration systemsand air-conditioning. Applications of refrigeration and Air-conditioning
UNIT 4	Transmission of Power: Introduction and types of Belt and Rope Drives, Gears.
UNIT 5	Primary Manufacturing Processes: Metal Casting Process: Introduction to Casting Process, Patterns, Molding, and Furnaces. Metal Forming Processes: Introduction to Forging, Rolling, Extrusion, Drawing. Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.
	Engineering Materials and Heat Treatment of Steel: Introduction to various engineering materialsand their properties.

Text Books	
1	G. Shanmugam and S Ravindran, Basic Mechanical Engieering, Mc Graw hill, fourth edition.
2	K Venu Gopal and Prabhu Raja V, Basic Mechanical Engineering, Anuradha agencies pub, Chennai.

1FY3-08/ 2FY3-08: BASIC ELECTRICAL ENGINEERING

Credit: 2 **Max. Marks: 100 (IA: 20, ETE: 80)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO12308.1	Ability to solve circuit using different kind of methods and theorems
CO12308.2	Ability to know the behaviors of basic electrical elements like resistor, inductor andcapacitor
CO12308.3	Students will be able to know the behaviors of transformer.
CO12308.4	Students will be able to know the behaviors of AC and DC machines.
CO12308.5	Students can use electronics components in the circuit after understanding its properties. Ability to know the behavior of LT switchgear, earthling and electrical power measurement

UNIT	Syllabus
UNIT 1	DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Series-Parallel circuits, Node voltage method, Mesh current method, Superposition, Thevenin‟s, Norton‟s and Maximum power transfer theorems.
UNIT 2	AC Circuits: Representation of sinusoidal waveforms, peak and r.m.s values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC and RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.
UNIT 3	Transformers: Ideal and practical transformer, EMF equation, equivalent circuit, losses intransformers, regulation and efficiency.
UNIT 4	Electrical Machines: Generation of rotating magnetic fields, Construction and working of a three- phase induction motor, Significance of torque-slip characteristic. Starting and speed control of induction motor, single- phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators.
UNIT 5	Power Converters: Semiconductor PN junction diode and transistor (BJT). Characteristics of SCR, power transistor and IGBT. Basic circuits of single phase rectifier with R load, Single phase Inverter,DC-DC converter.
	Electrical Installations: Layout of LT switchgear: Switch fuse unit (SFU), MCB, ELCB, MCCB,Type of earthing. Power measurement, elementary calculations for energy consumption

Text Books	
1	Basic Electrical and Electronics Engineering by Sukhija and Nagsarkar, Oxford Pub.
2	Basic Electrical & Electronics Engineering by Kothari, Nagrath, TMH
3	Basic Electrical & Electronics Engineering by V. Jagathesan, K. Vinod Kumar & R. SaravanKumar, Wiley India.
4	Basic Electrical & Electronics Engineering by Prasad/Sivanagraju, Cengage learningIndian Edition
5	Basic Electrical and Electronics Engineering by Muthusubrmaniam, TMH

1FY3-09/ 2FY3-09: BASIC CIVIL ENGINEERING

Credit: 2 **Max. Marks: 100 (IA: 20, ETE: 80)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO12309.1	Role of civil engineer and impact of infrastructure on society will be understood tostudents.
CO12309.2	Principles of surveying and levelling will be known to students.
CO12309.3	Student will be able to understand about foundation and parts of building
CO12309.4	Importance of transportation and traffic engineering will be known to students.
CO12309.5	Students will understand about problem related to environment.

UNIT	Syllabus
UNIT 1	Introduction to objective, scope and outcome the subject
UNIT 2	Introduction: Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.
UNIT 3	Surveying: Object Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying, Bearings and Longitude & Latitude of a Line, Introduction to total station. Leveling: Instrument used Object of leveling, Methods of leveling in brief, and Contour maps.
UNIT 4	Buildings: Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation
UNIT 5	Transportation: Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.
	Environmental Engineering: Environmental Pollution, Environmental Acts and Regulations, Functional Concepts of Ecology, Basics of Species, Biodiversity, Ecosystem, Hydrological Cycle; Chemical Cycles: Carbon, Nitrogen& Phosphorus; Energy Flow in Eco-systems. Water Pollution: Water Quality standards, Introduction to Treatment & Disposal of Waste Water. Reuse and Saving of Water, Rain Water Harvesting. Solid Waste Management: Classification of Solid Waste, Collection, Transportation and Disposal of Solid. Recycling of Solid Waste: Energy Recovery, Sanitary Land fill, On-Site Sanitation. Air& Noise Pollution: Primary and Secondary air pollutants, Harmful effects of Air Pollution, Control of Air Pollution. . Noise Pollution Harmful Effects of noise pollution, control of noise pollution, Global warming& Climate Change, Ozone depletion, Green House effect.

TEXT BOOK	
1	Palancharmy, Basic Civil Engineering, McGraw Hill publishers.
2	Satheesh Gopi, Basic Civil Engineering, Pearson Publishers.
3	Ketki Ranwala Dalal, Essentials of Civil Engineering, Charotar Publishing House.

1FY2-20/ 2FY2-20: ENGINEERING PHYSICS LAB

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO11220.1 & CO12220.1	Student will be able to measure the wavelength of light using Michelson's Interferometer, Newton's Ring and Diffraction Grating, dispersive power of a prism, numerical aperture of an optical fiber, coherence length as well as coherence time of a He-Ne LASER using Michelson's Interferometer and thereby learn the optical phenomena of classical and quantum wave optics.
CO11220.2 & CO12220.2	Student will be able to measure the band gap of a semiconductor material and Hall coefficient of a semiconductor by measuring it's Hall voltage and thereby learn the experimental technique to measure energy band gap and Hall coefficient of a semiconductor and learn to identify the type of semiconductor (p-type or n-type)
CO11220.3 & CO12220.3	Student will be able to measure the height of a distant object using Sextant and hence learn the use of a sextant to measure angle of inclination as well as learn the use of trigonometric ratios to find various distances.
CO11220.4 & CO12220.4	Student will be able to measure the time constant of a RC circuit, specific resistance of a wire by Carry Foster's bridge and hence learn the charging and discharging behaviour of a capacitor.

List of Experiments:

1. To determine the wave length of monochromatic light with the help of Michelson's interferometer
2. To determine the wave length of sodium light by Newton's Ring.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating withthe help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the same constant(both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fiber.
10. To study the Hall Effect and determine the Hall Voltage and Hall coefficients

1FY2-21/ 2FY2-21: ENGINEERING CHEMISTRY LAB

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO11122.1 & CO12122.1	Students will learn to pronounce and transcribe words after learningvarious phonetic symbols. They can also use this phonetics to improve their pronunciation.
CO11122.1 & CO12122.2	**S**tudents will get a revised knowledge of synonyms, antonyms and word formation.
CO11122.1 & CO12122.3	**S**tudents will be able to give seminar presentation on different topics andhave knowledge of group discussion.

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help ofK2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 atdifferent temperature Synthesis of Aspirin/ Paracetamol

1FY2-22/ 2FY2-22: LANGUAGE LAB

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO11123 & CO12123.1	Students will understand the importance of happiness and prosperity through identification of human values and skills**.**
CO11123 & CO12123.2	Students will understand the role of basic human aspirations, about harmony in family, society and the importance of trust and respect.
CO11123 & CO12123.3	Students will understand about the interconnectedness among the four orders of nature, recyclability, coexistence, professional ethics and competence.

List of Experiments:

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing
5. Listening comprehension.

Text Books:

1. **Technical Communication: principles and Practice, Meenakshi Raman & Sangeeta Sharma,Oxford University Press, India.**
2. **Effective Technical Communication, Barun K. Mitra, Oxford University Press, India.**
3. **Binod Mishra & Sangeeta Sharma, 'Communication Skills for Engineers and Scientists, PHI Learning Private Ltd, New Delhi, 2011.**
4. **Communication Skills, Pushplata & Sanjay Kumar, Oxford University Press, India.**
5. **Bhattacharya, Indrajit, An Approach to Communication Skills, Dhanpat Rai & Co. (Pvt) Ltd.,New Delhi.**
6. **Wright, Crissy, Handbook of Practical Communication Skills, Jaico Publishing House, Mumbai.**
7. **Gimson, A C, 'An Introduction to the Pronunciation of English', ELBS.**

1FY1-23/ 2FY1-23: HUMAN VALUES ACTIVITIES AND SPORTS

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO12105.1	Students will understand the importance of Happiness through Identification of HumanValues and Skills.
CO12105.2	Students will understand the role of basic human aspirations in self and people aroundthem.
CO11105.3	Students will understand about the harmony in family, in society and practicallyunderstand the importance of trust and respect as foundational value of relationship
CO11105.4	Students will understand the interconnectedness among the four orders of nature,recyclability, coexistence and harmony at all level of existence
CO11105.5	Students will understand to be prepared for humanistic education, professionalcompetence with ethics and humanistic universal order.

Content:

PS 1: Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

PS 2: Now-a-days, there is a lot of talk about many techno-genic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what doyou think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of „Natural Acceptance", based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our „Natural Acceptance" and may a time it is also clouded by our strong per-conditioning and sensory attractions).

Explore the following:

(i) What is Naturally Acceptable" to you in relationship the feeling of respect or

(ii) disrespect

for yourself and for others?

(iii) What is „naturally Acceptable" to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?

2. Out of the three basic requirements for fulfilment of your aspirations - right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable

b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!

2. List down all your important activities. Observe whether the activity is of „I" or of Body or with the participation of both or with the participation of both „I" and Body. Observe the activities within „i". Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

PS 5:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.

PS 6: List down some common units (things) of Nature which you come across in your daily life andclassify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

PS 7: Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values? If so, how should one proceed in this direction from the present situation?

PS 8:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

Project:

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

Sports:

a) Planning in Sports,
b) Sports & Nutrition
c) Yoga and Life style
d) Measures Physical Education & Sports for CWSN (Children with Special needs - Divyang)
e) Children & Sports
f) Women & Sports
g) Test & Measurement in Sports
h) Physiology & Sports
i) Sports Medicine
j) Kinesiology, Biomechanics & Sports
k) Psychology & Sports

1FY3-24/ 2FY3-24: COMPUTER PROGRAMMING LAB

Credit: 1.5 **Max. Marks: 75 (IA: 45, ETE: 30)** **0L+0T+3P**

Course outcome	Details
CO11324.1 & CO12324.1	To Design, implement, test and debug programs in C
CO11324.2 & CO12324.2	To implement and learn conditional statements
CO11324.3 & CO12324.3	To implement the different types of array and its
CO11324.4 & CO12324.4	To imply practical applications of structure and union
CO11324.5 & CO12324.5	To implement the concept of File Handling

List of Experiments:

1. To learn about the C Library, Pre-processor directive, Input-output statement.
2. Programs to learn data type, variables, If-else statement
3. Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
7. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10. Programs to learn Pointer operations
11. Programs to understand File handling operations Programs to input data through Command line argument

1FY3-25/ 2FY3-25: MANUFACTURING PRACTICES WORKSHOP

Credit: 1.5 **Max. Marks: 75 (IA: 45, ETE: 30)** **0L+0T+3P**

Course outcome	Details
CO11325.1 & CO12325.1	Student will be able to understand the basic tools and operations ofcarpentry shop with preparation of a simple joint
CO11325.2 & CO12325.2	Student will be able to understand the basics of foundry shop with preparation of sand mould and casting of simple pattern
CO11325.3 & CO12325.3	Students will be able to describe the basic tools used in welding shop with preparation of lap and butt joint
CO11325.4 & CO12325.4	Students will be able to learn about various parts and operations on Lathe machine with preparation of job
CO11325.5 & CO12325.5	Students will be able to understand the various tools and operations of fitting shop with preparation of job

List of Experiments:

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding Shop

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice

9. Job on lathe with one step turning and chamfering operations

Fitting and Sheet Metal Shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metalTo cut a square notch using hacksaw and to drill a hole and tapping

1FY3-26/ 2FY3-26: BASIC ELECTRICAL ENGINEERING LAB

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO12326.1	Students can identify basic electrical component and able to test and measure electrical quantities using digital and analog meters
CO12326.2	Students gets basic information about transformer.
CO12326.3	Student will be able to understand about star Delta connection of 3 phase transformer
CO12326.4	Students get complete information about AC & DC machine by cut out section
CO12326.5	Students get knowledge of design of different converters and LT switch gears

List of Experiments:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on an oscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (Commutator - brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
5. Torque Speed Characteristic of separately excited dc motor. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform
   (c) The use of dc-ac converter for speed control of induction motor and (d) Components of LTswitchgear.

1FY3-27/ 2FY3-27: BASIC CIVIL ENGINEERING LAB

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO11327 & CO12327.1	To understand the linear measurement with the help of tape and chain include ranging and laying offset method.
CO11327 & CO12327.2	Measurement of bearing of line with help of compass
CO11327 & CO12327.3	To be aware of the of leveling instruments during making of longitudinal and cross section of road and also able to take the measurements using the Total Station.
CO11327 & CO12327.4	Determine various water and waste water quality parameter like pH, hardness, and turbidity and solids.
CO11327 & CO12327.5	Describe the various water supplies and sanitary fitting.

List of Experiments:

1. Linear Measurement by Tape:
    a. Ranging and Fixing of Survey Station along straight line and across obstacles.
    b. Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of lines using Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
    a. To determine the reduced levels in closed circuit
    b. To carry out profile levelling and plot longitudinal and cross sections for road byHeight of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM,Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

1FY3-28/ 2FY3-28: COMPUTER AIDED ENGINEERING GRAPHICS

Credit: 1.5 **Max. Marks: 75 (IA: 45, ETE: 30)** **0L+0T+3P**

Course outcome	Details
CO11328 & CO12328.1	Use the drawing instruments effectively and able to dimension the given figure.
CO11328 & CO12328.2	Understand the systematic approach for projection of points & lines.
CO11328 & CO12328.3	Able to draw the basic views related to projection of lines & planes.
CO11328 & CO12328.4	Understand the theory of section of solid & projection of Section of solid including cylinders, cones, prism
CO11328 & CO12328.5	Understand the fundamentals of computer graphics.

Content:

Introduction: Principles of drawing, lines, type of lines, usage of Drawing instruments, lettering, Conic sections including parabola, hyperbola, Rectangular Hyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

Projections of Point & Lines: Position of Point, Notation System, Systematic Approach for projections of points, front view & Top view of point, Position of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book).

Projection of Planes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape of the plane, Distance of a point from plane, Angle between two planes.

Projections of Regular Solids: frustum and truncated solids, those inclined to both the Planes-Auxiliary Views.

Section of Solids: Theory of sectioning, section of prisms and cubes, section of pyramids and Tetrahedron section of Cylinders, section of cones, section of spheres (One drawing sheet, one assignment in sketch book)

Overview of Computer Graphics: Covering theory of CAD software [such as: The menu System, Toolbars (standard, Object Properties, Draw, Modify and Dimension), Drawing Area

(Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

Text Books:

1. **Engineering Drawing Geometrical Drawing P.S.Gill , S.K.Katara & Sons**
2. **Engineering Drawing,Dhanarajay A Jolhe ,Tata McGraw Hill.**
3. **Engineering Drawing, Basant Agarwal & CM Agarwal ,Tata McGraw Hill**
4. **Engineering Drawing, N.D.Bhatt, Charotar Publishing House Pvt. Ltd.**
5. **Engineering Drawing with an introduction to AutoCAD, Dhananjay A Jolhe**
6. **Engineering Drawing with AutoCAD, B.V.R. Gupta and M. Rajaroy**
7. **AutoCAD 2017 for Engineers & Designers (Basic and Intermediate), Sham Tickoo**

1FY3-29/ 2FY3-29: COMPUTER AIDED MACHINE DRAWING

Credit: 1.5 **Max. Marks: 75 (IA: 45, ETE: 30)** **0L+0T+3P**

Course outcome	Details
CO11329 & CO12329.1	Use the drawing instruments effectively and able to dimension the given figure.
CO11329 & CO12329.2	Understand the systematic approach for projection of points & lines.
CO11329 & CO12329.3	Able to draw the basic views related to projection of lines & planes.
CO11329 & CO12329.4	Understand the theory of section of solid & projection of Section of solid including cylinders, cones, and prism.
CO11329 & CO12329.5	Understand the fundamentals of computer graphics.

Content:

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, boltedjoints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotterand knuckle joints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc. Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, and pin type flexiblecoupling. Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CAD software such as: The menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Command Line (Where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple and compound Solids.

3ME2-01: ADVANCE ENGINEERING MATHEMATICS-I

Credit: 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO231.1	To demonstrate the concept of difference operator and interpolation and to understand of numerical methods over exact analytical methods.
CO231.2	To provide the values of first and second derivative numerically and provide approximate the integrals by various numerical methods and idea of numerical solution of ordinary differential equation.
CO231.3	To provide the basic idea of Laplace transform and their application to solve ordinary and partial differential equation with boundary conditions
CO231.4	To provide the concept of complex transform including the sine and cosine transform and their application. To solve wave and diffusion equation using Fourier transforms. The choice of particular transform to be used.
CO231.5	To provide the basic idea of Z- transform and their application to solve difference equation.

UNIT	Syllabus
UNIT 1	**Numerical Methods – 1:** Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.
UNIT 2	**Numerical Methods – 2:** Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method.
UNIT 3	**Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.
UNIT 4	**Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).
UNIT 5	**Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z- transform, application of Z-transform to difference equation.

Text Books	
1	Engineering Maths Vol-I by Chandrika Prasad, Standard Publishers and Distributers.
2	Vol-II by Chandrika Prasad, Standard Publishers and Distributers.
3	Higher Engineering Maths by Gaur & Kaul, Jaipur Publishing House.

3ME1-02/4ME1-02: TECHNICAL COMMUNICATION

Credit: 2 **Max. Marks: 100(IA: 30, ETE: 70)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO232.1	Understand the meaning and importance of technical communication and difeerent technical styles
CO232.2	Practice the unique qualities of professional rhetoric and writing style, such as sentence conciseness, clarity, accuracy, honesty.
CO232.3	Recognize, explain, and use the formal elements of specific genres of organizational communication: white papers, memorandums, web pages, wikis, blogs, business letters, and promotional documents.
CO232.4	Recognize, explain, and use the formal elements of specific genres of organizational communication: white papers, recommendation and analytical reports, proposals
CO232.5	Avoiding wordiness or ambiguity, using direct order organization, readability, coherence and transitional devices

UNIT	Syllabus
UNIT 1	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.
UNIT 2	**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.
UNIT 3	**Technical Writing, Grammar and Editing-** Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning,drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.
UNIT 4	**Advanced Technical Writing-** Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.
UNIT 5	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

Text Books	
1	Communication techniques grammatical aspects by Dr. Shukla Arora, Dr. Medhavi jain, Dr. Rita Arora.

3ME3-04: ENGINEERING MECHANICS

Credit: 2 **Max. Marks: 100(IA: 30, ETE: 70)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO234.1	Student will be able to define fundamental laws of Mechanics, identify the Conditions of equilibrium and apply those to solve problems of statics body and trusses.
CO234.2	Student will be able to locate the center of gravity and theorems of Moment of Inertia and apply it to calculate to moment of inertia of various bodies and study the working of lifting machine.
CO234.3	Student will be familiar friction, laws of friction, power transmission by belt and employ them to solve various applications of friction.
CO234.4	Student will be able to memorize the kinematics and dynamics by using Newton's Laws of motions and use them to solve problems of kinetics. And be able to relate work, Energy and power, understand law of conservation of energy and solve the problems involving work, energy and Power.
CO234.5	Student will be able to understand Introduction to work power energy ,& understand the concept of impulse momentum..

UNIT	Syllabus
UNIT 1	Statics of particles and rigid bodies: Fundamental laws of mechanics, Principle of transmissibility, System of forces, Resultant force, Resolution of force, Moment and Couples, Varignon's theorem, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem. Plane trusses: Types of structures, Trusses, Support Conditions, Types of Loadings, Classification of trusses, Determinacy of trusses, Basic assumptions of truss analysis, Method of joints, Method of sections. Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium.
UNIT 2	**Centroid & Moment of inertia**: Location of centroid and center of gravity, Moment of inertia, Parallel axis and perpendicular axis theorem, Radius of gyration, M.I of composite section, Polar moment of inertia, M.Iof solid bodies. **Lifting machines**: Mechanical advantage, Velocity Ratio, Efficiency of machine, Ideal machine, Ideal effort and ideal load, Reversibility of machine, Law of machine, Lifting machines; System of pulleys, Simple wheel and axle, Wheel and differential axle, Weston's differential pulley block, Worm and worm wheel, Single purchase winch crab, Double purchase winch crab, Screw jack, Differential screw jack.
UNIT 3	**Friction**: Types of Friction, Laws of friction, Angle of friction, Angle ofrepose, Ladder, Wedge, Belt Friction. **Belt and Rope drive**: Types of belts, Types of belt drives, Velocity ratio, Effect of slip on Velocity ratio, Crowing of pulleys, Length of belt, Ratio of tensions in flat belt drive, Power transmission by belt drives, Advantage and disadvantages of V-Belt over Flat Belt.
UNIT 4	**Kinematics of particles and rigid bodies**: Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration, Angular velocity and Angular acceleration, Radial and transverse velocities and accelerations, Projectiles motion on plane and Inclined Plane, Relative Motion. **Kinetics of particles and rigid bodies**: Newton's second law, Equation ofmotion in

	rectangular coordinate, Equation of motion in radial and transverse components, Equation of motion in plane for a rigid body, D'Alembert principle.
UNIT 5	**Work, Energy and power**: Work of a force, weight, spring force and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservative and Non-conservative Force, Conservationof energy. **Impulse and momentum**: Linear and angular momentum, Linear and angular impulse, Principle of momentum for a particle and rigid body, Principle of linear impulse and momentum for a particle and rigid body, Principle of angular momentum and Impulse, Conservation of angular momentum, Angular momentum of rigid body, Principle of impulse and momentum for a rigid body, Central impact, Oblique impact, System of variable mass, Rocket.

Text Books	
1	Engineering Mechanics by S.S Bhavikatti
2	*A* Textbook Of Engineering Mechanics : R.K. Bansal, Sanjai Bansal
3	A Textbook Of Engineering Mechanics by R.S. Khurmi & Gup

3ME4-05: ENGINEERING THERMODYNAMICS

Credit: 3 **Max. Marks: 100 (IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO235.1	Students will aware about the various basic concepts of thermodynamics.
CO235.2	Students will be able to understand the thermodynamic aspects of engines, pump and refrigerator. They can demonstrate the role of entropy and available energy for the purpose of analysis of a thermodynamic system.
CO235.3	Student will apply concepts of thermodynamics for evaluating the properties of pure substance. Students will be able to identify, formulate and solve thermal engineering problems related to real and ideal gasses.
CO235.4	Students will be able to utilize thermodynamic relations and understand a thermal system or a process that meets power generation.
CO235.5	Students will interpret and analyze power cycles.

UNIT	Syllabus
UNIT 1	**Basic Concepts and definitions of Thermodynamics**: System, Surroundings, Property, Energy, Thermodynamic Equilibrium, Process, work and modes of work. **Zeroth and First Law of Thermodynamics:** Zeroth of Thermodynamics**,** Temperature scale, First law of thermodynamics, First law analysis of some elementary processes. Steady and unsteady flow energy equations.
UNIT 2	**Second Law of Thermodynamics:** Heat engine, Heat pump and refrigerator, Second law of thermodynamics, Equivalence of the Kelvin-Plank and Clausius statements. Reversible and Irreversible Processes, Carnot engine, Efficiency of a Carnot engine, Carnot principle, thermodynamic temperature scale, Clausis Inequality. **Entropy**: Entropy, Calculation of Entropy change, Principle of entropy increase. Temperature-Entropy diagram, Second law analysis of a control volume. **Availability:** Available energy, Loss in available energy, Availability Function, Irreversibility.
UNIT 3	**Thermodynamic Properties of Fluids:** Pure substance, Concept of Phase, Graphical representation of p-v-T data, Properties of steam. Steam tables, Mollier chart. **Ideal Gas and Real Gas**: Ideal gas, Real gas, Internal energy, enthalpy and specific heats of an ideal gas, equations of state, Dalton's law of partial pressures, Gibbs Dalton law, Thermodynamic properties of gas mixtures.
UNIT 4	**Thermodynamic Relations:** Thermodynamic variables, Independent and dependent variables, Maxwell's thermodynamic relations, Thermodynamic relations involving entropy, Thermodynamic relations involving enthalpy and internal energy, Joule-Thomson coefficient, Clapeyron equation. **Power Cycles:** Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Ericsson cycle.
UNIT 5	**Vapour power cycle:** Rankine cycle, effect of operating conditions on its efficiency, properties of ideal working fluid in vapour power cycle. Reheat cycle, regenerative cycle, bleeding extraction cycle, feed water heating co-generation cycle.

Text Books	
1	A Textbook Of Thermal Engineering By R. K Rajput
2	Thermodynamics - An Engineering Approach | 9th Edition by Yunus A. Cengel.
3	Fundamentals of Engineering Thermodynamics 8 ED by Michael J Moran

3ME4-06: MATERIAL SCIENCE AND ENGINEERING

Credit: 3 **Max. Marks: 100 (IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO236.1	Student will remember the various crystal structures and defects
CO236.2	Student will be able to understand the general principles of phase transformation in alloys
CO236.3	Students will be able to describe the Isothermal transformation diagram
CO236.4	Students will be able to analyze about properties and applications of commodity and engineering polymers
CO236.5	Students will be able to estimate the mechanical properties and testing

UNIT	Syllabus
UNIT 1	**Crystal structure:** BCC, FCC and HCP, unit cell, crystallographic planes and directions, miller indices. Crystal imperfections, point, line, surface and volume defects. Frank Reed source of dislocation, Elastic & plastic modes of deformation, Bauschinger's effect, slip & twinning, strain hardening, cold/hot working recovery, re-crystallization and grain growth.
UNIT 2	**Classification of Engineering Materials:** Solidification of metals and of some typical alloys, mechanism of crystallization (I) nuclear formation (ii) crystal growth, general principles of phase transformation in alloys, phase rule and equilibrium diagrams, equilibrium diagram of binary system having complete mutual solubility in liquid state and limited solubility in solid state, binary isomorphous alloy system, Hume- Rothery rule , binary system with limited solid solubility of terminal phase and in which solubility decreases with temperature and also alloy with a peritectic transformation, equilibrium diagram of a system whose components are subject to allotropic change. Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram, eutectic, peritectic, eutectoid and peritectoid reactions and microstructures.
UNIT 3	**Isothermal transformation diagrams** –cooling curves superimposed on Isothermal Transformation diagram, critical cooling rate. (i) Formation of Austenite from Pearlite (ii) Transformation of Austenite into Pearlite. Full annealing, stress relief, spheroidizing – normalizing, hardening and tempering of steel. Hardenability, Jominey end quench test – Austempering, martempering. Case hardening, carburising, nitriding, cyaniding, carbonitriding. Flame and Induction hardening.
UNIT 4	Non-Metallic Materials- Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO,PPS, PEEK, PTFE Polymers.Urea and Phenol formaldehydes. Constitution of alloys: Solid solutions - substitutional and interstitial. Ferrous and Non Ferrous Metals- Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA steel.
UNIT 5	Mechanical Properties and Testing: Types of fracture, testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test. Classification of steels and cast iron constitution and properties. BIS standards. Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ etc. Fiber and particulate reinforced composites and resin plastics. Introduction to Nano materials- Nano structured materials. Nano clusters & Nano crystals.

Text Books

1	Introduction to Materials Science for Engineers by James Shackelford
2	Foundations of Materials Science and Engineering by William F. Smith Professor
3	Materials Science and Engineering: A First Course by Raghavan V

3ME4-07: MECHANICS OF SOLIDS

Credit: 4 **Max. Marks: 100 (IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO237.1	After completion of this course student will able to describe the concept and principles and perform calculation, relative to strength and stability and strength of mechanical components.
CO237.2	After completion of this course student will able to Evaluating the shear stress and bending stress of different types of sections.
CO237.3	After completion of this course student will able to Analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress and apply theories of failure.
CO237.4	After completion of this course student will able to Understand the concept of long and short columns subjected to load at different ends and able to solve the problem related to torsion.
CO237.5	After completion of this course student will able to Calculate the stresses in pressure vessels and deflection at any point on a beam by different types of methods.

UNIT	Syllabus
UNIT 1	**Stress and Strain:** Elementary definition of stress and strain, stress- strain relationship, elastic, plastic and visco-elastic behavior of common materials in tension and compression test, stress-strain curves, Hooke's law, Poisson's ratio, elastic constants and their relations for an isotropic hookean material, anisotropic and orthotropic materials. Tension, compression, shearing stress and strain, thermal stresses,composite bars, equations of static equilibrium, concept of free body diagram. Strain energy due to axial loading.
UNIT 2	**Members Subjected to Flexural Loads:** Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. bending stresses, section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc. Strain energy due to bending.
UNIT 3	**Principal Planes, Stresses and Strains:** Members subjected to combined axial, bending and torsional loads, maximum normal and shear stresses, concept of equivalent bending and equivalent twisting moments, Mohr's circle of stress and strain. **Theories of Elastic Failures:** The necessity for a theory, different theories, significance and comparison, applications.
UNIT 4	**Torsion:** Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Strainenergy due to torsional loads. **Stability of Equilibrium:** Instability and elastic stability, long andshort columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentricloading, Rankine formulae and other empirical relations.
UNIT 5	**Transverse Deflection of Beams:** Relation between deflection, bending moment, shear force and load, transverse deflection of beams and shaft under static loading, area moment method, direct integration method. **Thin-walled Pressure Vessels:** Stresses in cylindrical and spherical vessels

Text Books	
1	An Introduction to Mechanics of Solids" by S H Crandall.
2	Theory of Elasticity" by Timoshenko S P and Goodier J N
3	Strength Of Materials Mechanics Of Solids by R.K. Rajput, Kataria

3ME421: MACHINE DRAWING PRACTICE

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2321.1	Use the drawing instruments effectively and able to dimension the given figure.
CO2321.2	Understand the systematic approach for projection of points & lines.
CO2321.3	Able to draw the basic views related to projection of lines & planes.
CO2321.4	Understand the theory of section of solid & projection of Section of solid including cylinders, cones, prism.
CO2321.5	Understand the fundamentals of computer graphics

SN	CONTENTS
1.	Assembly drawing with sectioning and bill of materials of the following: Lathe tail stock, shaper tool head, swivel machine vice etc (1 drawing sheet of anyassembly)
2.	Detailed part drawings from assembly drawing indicating fits, tolerances and surface finish symbols by referring BIS codes: Check-valve, Junction Valve etc (1 drawing sheet)
3.	Computer Aided Drafting: Introduction to different features of the CAD Software (AutoCAD/ProE/ Creo/Solidworks). At least one drawing problemrelated to a. 2-D Drafting. b. 3-D Modeling. c. 3-D Advanced Modeling. d. Assembly modeling. e. Feature Modification and Manipulation f. Detailing. g. Surface Modeling

3ME4-22: MATERIALS TESTING LAB

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2322.1	Students will illustrate various crystals structures, micro structural examination and Comparative study of microstructures of different given specimens
CO2322.2	Students will have the basic understanding of heat treatment experiments and also study of hardness of steel at different rates of cooling.
CO2322.3	Student will be able to perform Tensile/Compressive/Shear/torsion, impact, fatigue, bending test on a given material.
CO2322.4	Students will get knowledge of Rockwell / Vickers / Brinell hardness of a given material.
CO2322.5	To impart knowledge and skill on creep testing machine to creep test.

Content

SN	Experiments
1	(a) Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids. Material identification of, say, 50 common items kept in a box.
2	Specimen preparation for metallographic examination /micro structural examination-cutting, grinding, polishing, etching.
3	Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
4	Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
5	Study of Microstructure and hardness of steel at different rates of cooling. Microstructure examination of white cast iron.
6	To perform Tensile/Compressive/Shear/torsion test on a given material and to determine its various mechanical properties under tensile/compression/Shear/torsional loading
7	To determine Rockwell/ Vickers/Brinell hardness of a given material
8	To perform Impact test on a given material and to determine its resilience.
9	To study and perform Fatigue test on a given material and to determine fatigue strength of the material
10	To perform Bending test and to determine the Young's Modulus of Elasticity via deflection of beam.
11	Creep testing on creep testing machine

3ME4-23: BASIC MECHANICAL ENGINEERING LAB

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2323.1	Students will have basic understanding of Basics of Mechanical engineering by having exposure to applications of mechanical engineering.
CO2323.2	Students will have hands on assembly & disassembly of machines.
CO2323.3	Students will be carrying out observational study of cut sections via computer simulations & videos
CO2323.4	Students will be learning design of simple machines
CO2323.5	Students will have knowledge of specification formulation & will also be visiting industries.

Content

SN	Experiments
1	Exposure to a wide range of applications of mechanical engineering through a variety of activities, including hands-on assembly and disassembly of machines, such as, bicycle, sewing machine, pumps, engines, air-conditioners, machine-tools, amongst others; observational study of complex systems via cut sections, visits, videos and computer simulations; design of simple machines/systems including specifications formulation; visits to industries.
2	Note: Student will be required to submit written report indicating the learning achieved by Hands on assembly/Disassembly.

3ME4-24: PROGRAMMING USING MATLAB

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2324.1	Students will be learning basics of MATLAB & usage of formulae functions in MATLAB.
CO2324.2	Students will be acquainted with MATLAB scripts &functions.
CO2324.3	Students will have knowledge of Loops , nested functions, array, vector & matrices.
CO2324.4	Students will be able to solve differential equations using MATLAB programming & will be well versed with plotting functions.
CO2324.5	Students will be learning file handling, MATLAB toolboxes & graphic functions.

Content

SN	Name of Experiments
1	Basics of MATLAB computer programming
2	Use of formulae and inbuilt functions
3	MATLAB scripts and functions (m-files)
4	Loops and nested loops
5	Array, vector and matrices
6	Plotting functions and vector plots
7	Solving differential equations using MATLAB
8	Reading and writing data, file handling
9	Using MATLAB toolboxes
10	MATLAB graphic functions

4ME2-01: DATA ANALYTICS

Credit: 2 **Max. Marks: 100(IA: 30, ETE: 70)**

2L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO241.1	Students will understand the methods of analyzing univariate and bivariate analysis
CO241.2	Students will be able to predict the outcome of multi variate regression problem by using techniques like ANOVA, ANCOVA, MANOVA and MANCOVA
CO241.3	Students will demonstrate the cases of logistic regression and they will be in position to apply Conjoint analysis to suitable real world problems
CO241.4	Students will apply techniques like principal component analysis, clustering analysis etc and will provide useful information from various case studies to society.
CO241.5	Students will be in position to provide appropriate decisions to real world problems by the application of decision trees like CHAID and CART.

UNIT	Syllabus
UNIT 1	**Introduction:** Objective, scope and outcome of the course. Introduction to Multivariate Statistics-Degree of Relationship among Variables-Review of univariate and Bivariate Statistics-Screening Data Prior to Analysis-Missing Data, Outliers, Normality, Linearity, and Homoscedasticity.
UNIT 2	Multiple Regression- Linear and Nonlinear techniques- Backward Forward-Stepwise- Hierarchical regression-Testing interactions (2way interaction) - Analysis of Variance and Covariance (ANOVA & ANCOVA) - Multivariate Analysis of Variance and Covariance (MANOVA & MANCOVA).
UNIT 3	Logistic regression: Regression with binary dependent variable –Simple Discriminant Analysis- Multiple Discriminant analysis Assessing classification accuracy- Conjoint analysis (Full profilemethod).
UNIT 4	Principal Component Analysis -Factor Analysis- Orthogonal and Oblique Rotation-Factor Score Estimation-Multidimensional Scaling- Perceptual Map-Cluster Analysis (Hierarchical Vs Nonhierarchical Clustering).
UNIT 5	Latent Variable Models an Introduction to Factor, Path, and Structural Equation Analysis- Time series data analysis (ARIMA model) – Decision tree analysis (CHAID, CART) - Introduction to Big Data Management.

Text Books	
1	K. Jain, Data Science & Analytics, Khanna Book Publishing, New Delhi
2	Dinesh Kumar, Business Analytics, Wiley India

4ME1-03/3ME1-03 : MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING

Credit: 2 **Max. Marks: 100(IA: 30, ETE: 70)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO243.1	Students will aware about the various managerial concepts.
CO243.2	Students will be able to understand the market conditions pertaining demand ,supply & elasticity situations with indepth analysis of demand &supply.
CO243.3	Student will be able to understand production concepts , various combination of output & input , different cost types & optimizing parameters.
CO243.4	Students will understand various types of markets in economic sense along with their salient features & competitive skills.
CO243.5	Students will get through financial anlaysis , ratio analysis, balance sheet concepts, and captial budgeting technique.

UNIT	Syllabus
UNIT 1	**Introduction:** Objective, scope and outcome of the course. **Basic economic concepts-** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.
UNIT 2	**Demand and Supply analysis-** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.
UNIT 3	**Production and Cost analysis-** Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.
UNIT 4	**Market structure and pricing theory-** Perfect competition, Monopoly, Monopolistic competition, Oligopoly.
UNIT 5	**Financial statement analysis-** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds- flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.

Text Books	
1	Managerial Economics & Business Strategy | McGraw-Hill
2	Managerial Economics | Wiley
3	Industrial Engineering & Operations Management, SK Sharma

4ME3-04: DIGITAL ELECTRONICS

Credit: 2 **Max. Marks: 100(IA: 30, ETE: 70)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO244.1	Understand the characteristic of diode, Zener diode and transistor and their application as rectifier, regulator and amplifier.
CO244.2	Understand the functioning of OP-AMP and OPAMP based circuits.
CO244.3	Explain the concept of timing circuits and oscillator.
CO244.4	Recognize the fundamental concept of digital electronics.
CO244.5	Illuminate the concept of electronics communication system.

UNIT	Syllabus
UNIT 1	**Introduction:** Objective, scope and outcome of the course **Semiconductor Devices and Applications:** Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.
UNIT 2	**Operational amplifier and its applications**: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.
UNIT 3	**Timing Circuits and Oscillators:** RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.
UNIT 4	**Digital Electronics Fundamentals**: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de- multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.
UNIT 5	**Electronic Communication Systems**: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Text Books	
1	Introduction to Digital Electronics (Essential Electronics Series) by J. Crowe
2	Digital Electronics: Principles, Devices and Applications by Anil K. Maini

4ME4-05: FLUID MECHANICS AND FLUID MACHINES

Credit: 4 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO245.1	Student will be able to define the properties of fluid, state basic equation of fluid statics & apply it to manometers, determine hydrostatic forces on surfaces & compare stability of floating & submerged bodies.
CO245.2	Student will be able to state the basic control volume equations & apply to fluid flow problems
CO245.3	Students will be able to identify the type of flow & express the relations in laminar & turbulent flow.
CO245.4	Students will be able to measure the pressure in pipe using flow measurement devices & identify the types of losses in pipes
CO245.5	Students will be able to describe classification, components & characteristics of hydraulic machines.

UNIT	Syllabus
UNIT 1	**Introduction:** Objective, scope and outcome of the course **Fluid Properties:** Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity,compressibility, vapor pressure, surface tension and capillarity. **Fluid Statics and Flow Characteristics:** Basic equation of fluid statics, Manometers, Force on plane areas and curved surfaces, center of pressure, Buoyant force, Stability of floating and submerged bodies. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.
UNIT 2	**Flow Through Circular Conduits:** Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram-minor losses – Flow through pipes in series and parallel.
UNIT 3	**Dimensional Analysis:** Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude – Dimensionless parameters-application of dimensionlessparameters – Modelanalysis.
UNIT 4	**Pumps:** Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exitof the rotor- velocity triangles - Centrifugal pumps– working principle- work done by the impeller - performance curves - Reciprocatingpump- working principle – Rotary pumps – classification.
UNIT 5	**Turbines:** Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan

	turbines- working principles - work done by wateron the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

Text Books	
1	Fluid Mechanics & Hydraulics by Dr. K.R, Arora, Standard Publishers & Distributers, Delhi.
2	Fluid Mechanics, Sadhu Singh, Khanna Publishing House, Delhi
3	Fluid Mechanics, Modi & Seth, Standard Publishers

4ME4-06: MANUFACTURING PROCESSES

Credit: 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO246.1	Student will remember different types of molding, casting methods with defects and causes and remedies in foundry
CO246.2	Student will be able to demonstrate the different type of forming, forging and rolling of process with advantages disadvantages and application
CO246.3	Student will be able to apply the different type of extrusion processes, press tool works and drawing operations
CO246.4	Student will be able to use different type of joining process with merits defect and remedies
CO246.5	Student will be able to understand different methods of powder formation along with compacting and sintering operation in powder metallurgy.

UNIT	Syllabus
UNIT 1	**Introduction:** Objective, scope and outcome of the course. General Classification and Introduction to Manufacturing processes. **Foundry Technology**: Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness; moisture content, clay content and permeability test. Core & core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification. Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting; centrifugal casting, investment casting; Permanent mould casting. Die casting; Slush casting. Casting defects; types, causes and remedy
UNIT 2	**Forming Processes**: Classification; Hot working and cold working;principle, advantages, disadvantages and applications. Forging: Classification, drop forging and press forging methods and use; Forging dies; types, materials Rolling: Characteristics and applications of hot rolling and coldrolling;
UNIT 3	Extrusion; Work materials and products; Press tool works; Basicprinciples, system, operations and applications. Shearing; Parting, notching, trimming, nibbling, blanking and piercing Drawing: wire drawing, tube drawing and deep drawing.
UNIT 4	**Metal Joining Processes**: Welding, Brazing and soldering, classification of welding process, Principle, characteristics and applications of gas welding, thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Principles and process details of Forge welding; Friction welding;Diffusion welding; Ultrasonic welding. Explosive welding. Welding defects; Types, causes, effects and remedy. Electrodes and Electrode Coatings
UNIT 5	**Powder Metallurgy**: Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy

Text Books	
1	Manufacturing Technology, Vol. 1, 2, 3, PN Rao, TMH
2	Manufacturing Technology, RK Rajput, Laxmi Publications
3	Production and Operations Management, S.N.Chary, TMH

ME4-07: THEORY OF MACHINES

Credit: 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO247.1	To make the student conversant with commonly used mechanism for industrial application.
CO247.2	To develop competency in drawing velocity and acceleration diagram for simple and complex mechanism
CO247.3	To develop analytical competency in solving kinematic problems using complex algebra method.
CO247.4	To apply graphical and analytical method for solving problems in static and dynamic force analysis.
CO247.5	To develop competency in conducting laboratory experiments for finding moment of inertia of rigid bodies,

UNIT	Syllabus
UNIT 1	**Introduction:** Objective, scope and outcome of the course. Introduction to mechanism: Basic concept of machines, links, kinematic pair, kinematic chain and mechanism. Inversions of kinematic chains: four bar chain mechanisms, quick return mechanisms, inversions of double slider crank mechanisms. Velocity and acceleration in mechanism: Velocity and accelerationpolygons, relative velocity and instantaneous centre method
UNIT 2	Friction devices: Types and laws of friction. Pivots and collars. Power screws such as lead screw of the lathe. Clutches: Single and multi-plate clutches. Brakes: Band, block andband and block brakes
UNIT 3	Gears: Laws of gearing, gears terminology; tooth form; interference, undercutting and minimum number of teeth on pinion. Rack and pinion, Spur, helical, basic introduction of bevel, worm and wormgears. Gear Trains: Simple, compound and epicyclic gear trains.
UNIT 4	Cams: Type of cams; displacement, velocity and acceleration curves For different cam followers; consideration of pressure angle and wear Gyroscope: Principles of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicles taking a turn, stabilization of ship.
UNIT 5	Balancing: Balancing of rotating masses in same and different planes,balancing of reciprocating masses, swaying couple, hammer blow and tractive effort.

Text Books	
1	Theory of Machines, SS Rattan, Tata McGraw Hill
2	Kinematics & Theory of Machines, Sadhu Singh, Pear

4ME3-21: DIGITAL ELECTRONICS LAB

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2421.1	Students will be learning logic gates & will be able to verify truth table.
CO2421.2	Students will be able to realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates
CO2421.3	CO2421.3 Students will be able to realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor & basic Full Adder/ Subtractor&will also realize the multiplexer using basic gates only
CO2421.4	CO2421.4 Students will be able to Design & Realize a combinational circuit
CO2421.5	CO2421.5 Stuidents will be able to realize the R-S, J-K and D-flip flops with and without clock signal Using basic logic gates & will be able to Construct asynchronous counter.& 4-bit binary counter and ring counter

Content

SN	Name of Experiments
1	To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Alsoto verify the truth table of Ex-OR, Ex-NOR (For 2, 3 & 4 inputs using gates with 2, 3, & 4 inputs).
2	To verify the truth table of OR, AND, NOR, Ex-OR. Ex-NOR realized using NAND & NOR gates.
3	To realize an SOP and POS expression.
4	To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND &NOR gates and to verify their truth tables.
5	To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor& basic Full Adder/ Subtractor.
6	To verify the truth table of 4-to-l multiplexer and l-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and l-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer.
7	Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -3 I 2 seven-segment display.
8	Using basic logic gates, realize the R-S, J-K and D-flip flops with and withoutclock signal and verify their truth table.
9	Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10	Perform input/output operations on parallel in/parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

4ME4-22: FLUID MECHANICS LAB

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2422.1	Student will able to determine metacentric height of body and different coefficients of orifice
CO2422.2	Student will able to find velocity of water through pitot tube, verification of Bernoulli's theorem and calibration of orifice/venturi meter
CO2422.3	Students will be able to characterize the flow field based on the Reynolds number.
CO2422.4	Students will be able to visualize the flow around the objects using flow visualization techniques.
CO2422.5	Student will study various turbines like Pelton, Kaplan and Francis turbines

Content

SN	Name of Experiments
1	Determination of Meta-centric height of a given body.
2	Determination of Cd, Cv & Cc for given orifice.
3	Calibration of contracted Rectangular Notch and / Triangular Notch anddetermination of flow rate.
4	Determination of velocity of water by Pitot tube.
5	Verification of Bernoulli's theorem.
6	Calibration and flow rate determination using Venturimeter & Orifice meterand Nozzle meter
7	Determination of head loss in given length of pipe.
8	Determination of the Reynold's number for laminar, turbulent and transient flow in pipe.
9	Determination of Coefficient for minor losses in pipes.
10	To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
11	To study the boundary layer velocity profile over a flat plate and to determinethe boundary layer thickness.
12	Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump.
13	Conducting experiments and drawing the characteristic curves of reciprocatingpump.
14	Conducting experiments and drawing the characteristic curves of Pelton wheel.
15	Conducting experiments and drawing the characteristics curves of Francis turbine.
16	Conducting experiments and drawing the characteristic curves of Kaplan turbine.

4ME4-23: PRODUCTION PRACTICE LAB

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2423.1	Students will have complete knowledge about lathe machine along with all the operations done with the help of lathe machine
CO2423.2	Students are expected to have knowledge about milling & shaper machine .Students will also gain insight about single point cutting tool & cylindrical grinding.
CO2423.3	Students will be demonstrated eccentric turning &generation of surfaces through lathe & milling machine. Preparation of tool layout through capstan lathe & grinding of milling cutters will be acknowledged to students.
CO2423.4	Students will be able to perform various tests on soil and check permeability, moisture & clay content of soil. Students will hands on preparation of sand moulds
CO2423.5	Students are expected to learn various types of joining processes and select the appropriate one according to the application

Content

SN	Name of Experiments
	Turning Shop
1	To study lathe machine construction and various parts including attachments, lathe tools cutting speed, feed and depth of cut.
2	To perform step turning, knurling and chamfering on lathe machine as per drawing.
3	To cut multi-start Square/Metric threads on lathe machine.
4	Boring using a boring bar in a centre lathe and cut BSW/Metric internalthreads on lathe machine.
5	To perform taper turning using compound rest.
	Machine shop
1	To study the milling machine, milling cutters, indexing heads and indexingmethods and to prepare a gear on milling machine.
2	To machine a hexagonal /octagonal nut using indexing head on milling machine.
3	To study of single point cutting tool geometry and to grind the tool as per giventool geometry.
4	To study shaper machine, its mechanism and calculate quick return ratio. To prepare a job on shaper from given mild steel rod.
5	Cylindrical grinding using grinding attachment in a centre lathe
	Demonstration and study
1	Demonstration for job by eccentric turning on lathe machine.
2	Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
3	Demonstration on milling machine for generation of plane surfaces and use of end milling cutters.
4	Grinding of milling cutters and drills.
	Foundry Shop

1	To prepare mould of a given pattern requiring core and to cast it in aluminium.
2	To perform moisture test and clay content test.
3	To perform permeability test
4	A.F.S. Sieve analysis test.
5	Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).
	Welding Shop
1	Hands-on practice on spot welding.

4ME4-24: THEORY OF MACHINES LAB

Credit: 1.5 **Max. Marks: 100 (IA: 60, ETE: 40)** **0L+0T+3P**

Course outcome	Details
CO2424.1	Students *will exemplify* inversion of four bar chain and slider crank mechanism.
CO2424.2	Students will able to understand quick return and inversion of double slider chain
CO2424.3	Students create various cam follower arrangements and coefficient of friction using two roller oscillating arrangement
CO2424.4	Students will able to analyze various types of dynamometers, Brakes and Clutches, differential gear box
CO2424.5	Student will be able to perform wheel balancing, verify torque relation and also get knowledge of lathe gear box, sliding mesh automobile gear box, planetary gear box.

Content

SN	Name of Experiments
1	To study inversions of four bar chain and slider crank mechanism and their practical applications.
2	To study Steering Mechanisms: Davis and Ackerman.
3	Study of quick return mechanism and its practical applications.
4	Study of inversion of Double slider chain: Oldham Coupling, Scotch Yoke and Elliptical Trammel.
5	Study of various cam-follower arrangements. To plot displacement v/s angle of rotation curve for various cams
6	To determine co-efficient of friction using two roller oscillating arrangement.
7	Study of various types of dynamometers, Brakes and Clutches.
8	Study of differential gear box.
9	To verify the torque relation for gyroscope.
10	To perform wheel balancing. To perform static and dynamic balancing on balancing set up.
11	Study of a lathe gear box, sliding mesh automobile gear box, planetary gearbox.

5ME2-01: MECHATRONIC SYSTEMS

Credit: 2 **Max. Marks: 100(IA: 20, ETE: 80)**

2L+0T+0P **End Term Exam: 2 Hours**

Course outcome	Details
CO351.1	Students will be able to learn major concepts in areas of language translation and compiler design
CO351.2	Students will be able to ability to identify, formulate, and solve computer engineering problems with proper systematic & semantic approach
CO351.3	Students will be able to Develop possible program constructs for further code generation with Type checking.
CO351.4	Students will be able to learn various concepts of symbol tables, Run time environments, memory management strategy.
CO351.5	Students will get the concepts of Intermediate code generation, Code optimization and Code generations

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Overview of Mechatronics: Historical perspective, Definition, Applications, Block diagram of Mechatronic system, Functions of Mechatronics Systems, Systems Engineering, Verification Vs Validation, Benefits of mechatronics in manufacturing. Electrical and Electronic Systems: Electrical circuits and Kirchhoff's laws, Network Theorems and AC circuit Analysis,Transformers, Analog Devices, Signal Conditioning, Digital Electronics, Data Acquisition systems.
UNIT 2	Modeling, Analysis and Control of Physical Systems: Basics of System Modeling: LTI and LTV systems, Need for modeling, Types of modeling, Steps in modeling, Building blocks of models, Modelling of one and two degrees of freedom systems, Modeling of Electro- mechanical systems, Mechanical Systems, Fluid systems, Thermal systems; Dynamic Responses, System Transfer Functions, State Space Analysis and System Properties, Stability Analysis using Root Locus Method, Stability Analysis using Bode Plots, PID Controllers(with and without Time Delay)
UNIT 3	Sensors and Actuators: Static characteristics of sensors and actuators, Position, Displacement and Proximity Sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors, Actuators: Electrical Actuators (Solenoids, Relays, Diodes, Thyristors, Triacs, BJT, FET, DC motor, Servo motor, BLDC motor, ACmotor, Stepper motors), Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys
UNIT 4	Microprocessors, Microcontrollers and Programmable Logic Controllers: Logic Concepts and Design, System Interfaces, Communication and Computer Networks, Fault Analysis in Mechatronic Systems, Synchronous and Asynchronous Sequential Systems, Architecture, Microcontrollers
UNIT 5	Programmable Logic Controllers (PLCs): Architecture, Number Systems Basics of PLC Programming, Logics, Timers and Counters, Application on real time industrial automation systems. Case Studies: Design of pick and place robot, Car engine management system, Automated manufacturing system, Automatic camera, Automatic parking system, Safety devices and systems.

Text Books	
1	A Textbook of Mechatronics, RK Raput, S.Chand Publishing
2	Mechatronics: Principles, Concepts and applications, Mahalik N.P, Tata McGraw Hill
3	Introduction to Mechnotronics, Kuttan, Oxford University

5ME4-02: HEAT TRANSFER

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO352.1	Understand the basic laws governing heat transfer.
CO352.2	Write, derive, understand & apply basic laws of heat transfer and differential equations
CO352.3	Governing heat transfer phenomenon
CO352.4	To understand the fundamentals of heat transfer in fluids and solids and their applications in various heat transfer equipments used in thermal power plants and process industries
CO352.5	To enable the student to identify, formulate and solve the fundamental problems of engineering in the field of energy transfer

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Introduction: Heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient. Conduction: General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation
UNIT 2	Heat transfer from extended surfaces: Governing differential equation of fin, fin efficiency and effectiveness for different boundary conditions .Unsteady state heat conduction for slab, cylinder and sphere, Heisler chart. Convection: Review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes
UNIT 3	Natural convection: Dimensional analysis, Grashoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations. Heat transfer with change of phase: Nature of vaporization phenomena; different regimes of boiling heat transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.
UNIT 4	Heat exchanger: Types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor. Constructional and manufacturing aspects of Heat Exchangers.
UNIT 5	Thermal Radiation: Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces. Constructional and manufacturing aspects of Heat Exchangers.

Text Books	
1	A Textbook Of Heat And Mass Transfer by R.K Rajput
2	Heat and Mass Transfer by P. K Nag
3	Fundamentals of Engineering Heat and mass Transfer by R.C. Sachdeva
4	Thermal Engineering, M.L. Mathur & F.S. Mehta, Jain Publications
5	A Course in Heat & Mass Transfer, V.M. Domkundwar, Dhanpat Rai & Co.

5ME4-03: MANUFACTURING TECHNOLOGY

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO353.1	Student will be able to understand the basic terminology used in Metal Removal Rate.
CO353.2	Student will be able to apply evaluation of types of errors may occur in machine tool.
CO353.3	Students will be able to have knowledge of use of different types of machine tool
CO353.4	Students will be able to operate and use of various types of method of grindings.
CO353.5	Students will be able for High Velocity Forming Methods.

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Classification of metal removal process and machines: Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS. Concept of orthogonal and oblique cutting. Type of chips, Mechanics of metal cutting; interrelationships between cutting force, shear angle, strain and strain rate. Thermal Aspects of machining and measurement of chip tool interfacetemperature.
UNIT 2	Concept of machinability, machinability index, factors affecting machinability, Different mechanism of tool wear. Types of tool wear (crater, flank etc), Concept of tool life. Taylor's tool life equation. Introduction to economics ofmachining. Cutting fluids: Types, properties, selection and application methods.
UNIT 3	Basic machine tools: Constructional configuration, estimation of machining time on lathe, drilling, shaping, milling, grinding, Gear cutting on milling, Gear hobbling Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, operational planning and turret tool layout,sequence of operations
UNIT 4	Introduction to Grinding and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications. Honing, lapping, super-finishing.
UNIT 5	High Velocity Forming Methods: Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.

Text Books	
1	Manufacturing Technology, Vol. 1, 2, 3, PN Rao, TMH
2	Manufacturing Technology, RK Rajput, Laxmi Publications
3	Production and Operations Management, S.N.Chary, TMH

5ME4-04: DESIGN OF MACHINE ELEMENTS – I

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO354.1	Student is able to explain the fundamental mechanical properties with their codes, standardization, interchangeability and design considerations.
CO354.2	The student will be in acquaintance with different terminology with understanding of safety, stress concentration and design of cotter, knuckle joint.
CO354.3	The students will able to exhibit the capability to apply the fundamentals in the design of machine components e.g. beams , spring , key , coupling , and joints
CO354.4	The students will express the ability to make proper assumptions, perform correct analysis while taking various failures criteria in shaft due to direct and various combined loading.
CO354.5	The student will be proficient in the analysis and design of bolts power lead screw, screw jack and crane hook etc.

UNIT	Syllabus
UNIT 1 **UNIT 2**	Materials: Mechanical Properties and IS coding of various materials, Selection of material from properties and economic aspects.
	Manufacturing Considerations in Design: Standardization, Interchangeability, limits, fits tolerances and surface roughness, BIS codes, Design consideration for cast, forged and machined parts. Design for assembly.
UNIT 3 **UNIT 4**	Design for Strength: Modes of failure, Strength and Stiffness considerations, Allowable stresses, factor of safety, Stress concentration: causes and mitigation, fatigue failures.
	Design of Members subjected to direct stress: pin, cotter and keyed joints.
UNIT 5	Design of Members in Bending: Beams, levers and laminated springs. Design for stiffness of beam: Use of maximum deflection formula for various end conditions for beam design.
UNIT 1 **UNIT 2**	Design of Members in Torsion Shaft and Keys: Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading. Sunk keys.
	Couplings: Design of muff coupling, flanged couplings: rigid and flexible.
UNIT 3	Design of Threaded fasteners: Bolt of uniform strength, Preloading of bolts: Effect of initial tension and applied loads, Eccentric loading
	Power screws like lead screw, screw jack.
	Design of members which are curved like crane hook, body of C clamp, machine frame etc

Text Books	
1	Design Data Book, Mahadevan, CBS Publishers & Distributors
2	Introduction to Machine Design, V.B. Bhandhari, McGraw Hill
3	A Textbook of Machine Design, RS Khurmi, S.Chand Publication

5ME4-05: PRINCIPLES OF MANAGEMENT

Credit: 3 **Max. Marks: 100(IA: 20, ETE: 80)**

2L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO355.1	Students will aware about the concepts of management.
CO355.2	Students will be able to understand the functions of management & organization structure& culture.
CO355.3	Student will be able to understand human resource management, performance appraisal techniques,& career strategy.
CO355.4	Students will understand various types of human factors leading to motivation, effective communication & Decision making process.
CO355.5	Students will get through management practices of famous personalities & their leadership profiles.

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Basic concepts of management: Definition – Need and Scope – Different schools of managementthought – Behavioural, Scientific, Systems, and Contingency Contribution of Management Thinkers: Kautilya, Taylor, Fayol, Peter Drucker and C.K. Prahlad.
UNIT 2	Functions of Management: Planning: Essentials of Planning and Managing by Objectives; Strategies, Policies and Planning Premises; Decision making. Organizing. The Nature of organizing, Entrepreneuring, and Reengineering; Organizational Structure, Departmentation; Line/staff authority, empowerment, and decentralization; Effective organizing and organization culture;
UNIT 3	Staffing Human resource Management and Selection; Performance Appraisal and Career Strategy; managing changethrough Manager and Organization Development.
UNIT 4	Leading Human Factors and Motivation; Leadership: Committees, Terms, and Group Decision making; Communication. Controlling. The system and process of controlling; Control Techniques and Information Technology; Productivity, Operations Management andTotal Quality Management.
UNIT 5	Management practices of: Dhirubhai Ambani, Narayan Murthy, Premji, Ratan Tata, Steve Jobs,Bill Gates. Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied above and justifying why such structures are chosen by those organizations. Preparing the leadership profiles of any 5 business leaders andstudying their leadership qualities.

Text Books	
1	Engineering Management: Industrial Engineering & Management, SC Sharma, Khanna Publishing House, Delhi
2	Industrial Engineering & Operations Management, SK Sharma

5ME4-12: AUTOMOBILE ENGINEERING

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End Term Exam: 3 Hours**

Course outcome	Details
CO356.1	After completion of course student will be able to work with frame, body , clutch and brakes.
CO356.2	After completion of course student will be able understand gearboxes and drives.
CO356.3	After completion of the course the student will understand wheel and tyres, steering system and suspension system.
CO356.4	Student will learn about the Automative electrical system and ignition system.
CO356.5	Students will learn about the automotive air conditioning and automotive safety.

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Frame & Body: Layout of chassis, types of chassis frames and bodies, their constructional features and materials. Clutches: single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. Brakes: Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.
UNIT 2	Gear Boxes: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter; Drives: Overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types;Front wheel and All wheel drive.
UNIT 3	Wheels and Tyres: Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre, Steering system: steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types. Suspension system: objective and requirements, Suspension spring, front and rear suspension systems, Independentsuspension system Shock absorbers.
UNIT 4	Automotive Electrical System: Battery construction, Chargingand testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification. Ignition System: Magneto and coil ignition systems, System Components and requirements, Automotive lighting: Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.
UNIT 5	Automotive Air Conditioning: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (GlobalPositioning System)

Text Books	
1	**Automotive Engineering, Kirpal Singh, Standard Publishers**
2	Automobile Mechanics, A.K. Babu & S.C. Sharma, T.R. Banga, Khanna Book Publishing

5ME3-21: MECHATRONICS LAB

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO3521.1	Students will be learning Characteristics of Strain Gauge, Amplifier & opto transducer.
CO3521.2	Students will be taught programming for mobile robots.
CO3521.3	Students will be learning Ladder programming on Logic gates ,Timers & counters digital & Analogy sensors
CO3521.4	Students will be sample programmes on MATLAB
CO3521.5	Students will be simulating & analyzing PID controller using SIMULINK

Content

SN	NAME OF EXPERIMENT
1	Using Transducers Kit :- • Characteristics of LVDT • Principle & Characteristics of Strain Gauge • Characteristics of Summing Amplifier • Characteristics of Reflective Opto Transducer
2	Mobile Robot • Program for Operating Buzzer Beep • Program for Operating Motion control • Program for Operating Direction control • Program for Operating White line follower for the given arena
3	PLC PROGRAMMING • Ladder programming on Logic gates ,Timers & counters • Ladder Programming for digital & Analogy sensors • Ladder programming for Traffic Light control, Water level control and Lift control Modules
4	MATLAB Programming • Sample programmes on Mat lab • Simulation and analysis of PID controller using SIMULINK
	Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation of sessional component shall include 30% weight age to mini project. • Mini project can be integration of sensor, actuator and transduction units for various home and office applications.

5ME4-22: HEAT TRANSFER LAB.

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO3522.1	Student will learn the thermal conductivities of insulating powder and the metal rod.
CO3522.2	Student will learn the transfer rate and temperature of pin fin with the emissivity of test surface
CO3522.3	Student will learn about the Stefan Boltzmann constant and surface heat transfer co efficient in vertical cylinder, drop wise and film wise condensation.
CO3522.4	Student will learn about the heat flux in saturated pool boiling and compare LMTD in parallel and counter flow heat exchangers.
CO3522.5	Student will learn lumped heat capacity method and heat transfer through forced convection in different materials.

Content

SN	NAME OF EXPERIMENT
1	To Determine Thermal Conductivity of Insulating Powders.
2	To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3	To determine the transfer Rate and Temperature Distribution for a Pin Fin.
4	To Measure the Emissivity of the Test plate Surface.
5	To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.
6	To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
7	Determination of Heat Transfer Coefficient in Drop Wise and Film Wise condensation.
8	To Determine Critical Heat Flux in Saturated Pool Boiling.
9	To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
10	To Find the Heat transfer Coefficient in Forced Convection in a tube.
11	To study the rates of heat transfer for different materials and geometries
12	To understand the importance and validity of engineering assumptions through the lumped heat capacity method.
	Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum fivestudents. Final evaluation sessional component shall include 30% weight age to mini project. • Heat exchanger design for different applications, designing for thermalinsulation, Use of relevant BIS codes for designing.

5ME4-23: PRODUCTION ENGINEERING LAB

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO3523.1	Students will have knowledge of measuring tools, measurement of angles & measurement of gaps.
CO3523.2	Students will be able to measure gear tooth thickness & will be able to check gear profile accuracy.
CO3523.3	Students will be able to measure flatness, surface defects with monochromatic check light& will be able to check the accuracy of a ground, machined and lapped surface
CO3523.4	Students will be able to find Chip reduction co-efficient in Single point turning.
CO3523.5	Students will be able to measure force, torque & thrust during turning, drilling & milling Operation. Also students will have an idea of measuring Chip tool Interface

Content

SN	NAME OF EXPERIMENT
1	Study of various measuring tools like dial gauge, micrometer, vernier caliper and telescopic gauges.
2	Measurement of angle and width of a V-groove by using bevel protector..
3	(a) To measure a gap by using slip gauges (b) To compare & access the method of small-bore measurement with the aidof spheres.
4	Measurement of angle by using sine bar.
5	(a) Measurement of gear tooth thickness by using gear tooth vernier caliper. (b) To check accuracy of gear profile with the help of profile projector.
6	To determine the effective diameter of external thread by using three- wire Method.
7	To measure flatness and surface defects in the given test piece with the help of Mono chromatic check light and optical flat.
8	To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.
9	Find out Chip reduction co-efficient (reciprocal of chip thickness ratio) during Single point turning.
10	Forces measurements during orthogonal turning.
11	Torque and Thrust measurement during drilling.
12	Forces measurement during plain milling operation.
13	Measurement of Chip tool Interface temperature during turning using Thermocouple technique.
	• Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project. Fabrication of an assembly in which parts shall be machined andstandard parts shall be procured.

5ME4-24: MACHINE DESIGN PRACTICE - I

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)** **0L+0T+2P**

Course outcome	Details
CO3524.1	Students will be be learning material properties and material selection.
CO3524.2	Students will be able to select fit and will be able to assign tolerances.
CO3524.3	Students will have knowledge of production consideration.
CO3524.4	Students will be design Knuckle & Cotter Joint.
CO3524.5	Students will design screw fastenings ,keyed joints & shaft couplings.

Content

SN	NAME OF EXPERIMENT
1	Material selection and relevant BIS nomenclature
2	Selecting fit and assigning tolerances
3	Examples of Production considerations
4	Problems on:
	(a) Knuckle & Cotter joints
	(b) Torque: Keyed joints and shaft couplings
	(c) Design of screw fastening
	(d) Bending: Beams, Levers etc.
	(e) Combined stresses: Shafts, brackets, eccentric loading.
	Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project. • Design and analysis of simple mechanical systems/products

6ME3-01: MEASUREMENT AND METROLOGY

Credit: 2 **Max. Marks: 100(IA: 20, ETE: 80)**

2L+0T+0P **End TermExam:2 Hours**

Course outcome	Details
CO361.1	Students will be able to understand generalized measuring system & errors in measurement.
CO361.2	Students will know the usage of Linear measuring instruments ,Comparators & sine bar.
CO361.3	Students will be able to understand Form measurement & surface finish measurement
CO361.4	Students will be able to develop knowledge about Coordinate measuring machine & measurement of power, torque& force.
CO361.5	Students will get the concepts of measurement of flow

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Concept to measurement: General concept to measurement, Need for measurement, Generalized measuring system, Units, Standards, Sensitivity, Readability, Range of accuracy, Precision, Accuracy Vs precision, Uncertainty Repeatability and reproducibility, Errors in measurement, Types of error, Systematic and random error, Calibration, Interchangeability.
UNIT 2	Linear and angular measurements: Linear measuring instrument Vernier caliper, Micrometer, Interval measurements:- Slip gauges, Checking of slip gauges for surface equality, Optical flat, Application of limit gauges Comparators:- Mechanical comparators, Electrical comparator, Optical comparator, Pneumatic comparator; Sine bar, Use of sine bar, Limitations of sine bars, Sources of error in sine bars, Bevel protractor, Applications of bevel protractor.
UNIT 3	Form measurement: Introduction, Screw thread measurement, Thread gauges, Measurement of gears: Gear errors. Surface finish measurement:-Introduction Elements of surface texture, Analysis of surface finish, Methods of measuring surface finish, Straightness measurement, Flatness testing, Roundness measurements
UNIT 4	Coordinate measuring machine (CMM):-Types of CMM, Features of CMM, Computer based inspection, Measurement of power, flow and temperature related properties Measurement of force, Accelerometer, Load cells, Bourdon tube. Torque measurement: Torque measurement using strain gauges, Torque measurement using torsion bars, Mechanical dynamometers.
UNIT 5	Measurement of flow: Variable area meters – Rota meter, Hot wire anemometer, Pitot tube. Temperature measurement, Bimetallic strip, Thermocouples (Thermoelectriceffects), Thermistors, Pyrometers

Text Books	
1	Mechanical Measurements , Beckwith T.G. ,N.L. Buck, and R.D. Marangoni , Addison Wesley
2	Dimensional Metrology . Khare & Vajpayee, Oxford & IBH
3	Engineering Metrology, Jain R.K., Khanna Publishers

6ME4-02: COMPUTER INTEGRATED MANUFACTURING SYSTEMS (CIMS)

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End TermExam:3 Hours**

Course outcome	Details
CO362.1	Students will be able to gain the knowledge of Automation in Production Systems
CO362.2	Students will be able to differentiate between NC system & CNC system along with advantages & disadvantages.
CO362.3	Students will get an overall idea about NC Part programming & Computer Aided Process Planning:
CO362.4	Student will be able to apply computer aided production management system
CO362.5	Student will be able to create computer aided material handling system

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Introduction to CIM: Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in Manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Numerical Control (NC): Basic components of an NC system, coordinate system and motions control systems. Computer Numerical Control (CNC): features of CNC, machine control unit, CNC software. Direct Numerical Control and Distributed Numerical Control .Applications, advantages and disadvantages of NC. Adaptive control of machining system.
UNIT 2	NC Part programming: Manual and computer assisted part programming, Part programming with APT. NC part programming using CAD/CAMsoftware.NC cutter path verification.
UNIT 3	Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data systems, computer generated time standards. Group Technology: Introduction, part families, part classification And coding, coding system and machining cells.
UNIT 4	Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory Management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. Computer Aided Quality Control; Computer in quality control, contact inspection methods, Non-contact inspection methods, Optical and non-optical computer aided testing.
UNIT 5	ComputerAidedMaterialHandling;Computercontrolonmaterialhandling,conveying,picking.Warehousecontrol,computerized Material handling for automated inspection and assembly. Computer Integrated Manufacturing Systems: Introduction, type's special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering; Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.

Text Books	
1	**Automation, Production Systems, and Computer-Integrated Manufacturing 4th Edition, Kindle Edition By Mikell P. Groover**
2	Computer Integrated Manufacturing by James A. Rehg
3	Rao P.N., CAD / CAM Principles and Applications, McGraw Hill.

6ME4-03: MECHANICAL VIBRATIONS

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End TermExam:3 Hours**

Course outcome	Details
CO363.1	Students will be able to acquire knowledge of introduction of Vibration, sound and noise.
CO363.2	Students will be able to define Damped and Undamped Single Degree of Freedom System.
CO363.3	Students will be able to explain principle & working of Forced Vibrations of Single Degree of Freedom Systems.
CO363.4	Students will be able to analyze System with Two Degrees of Freedom and Critical Speed of Shaft
CO363.5	Students will be able to compare Many Degrees of Freedom Systems (Exact analysis and approximate methods)

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Introduction to Sound: Frequency dependent human response tosound, Sound pressure dependent human response, Relationship among sound power, sound intensity and sound pressure level. Introduction to Noise: Auditory and Non auditory effects of Noise, Major sources of the noise, Industrial noise sources, Industrial noise control strategies. Introduction to Vibration: Importance and scope of vibrations, terminology and classification, Concept of Degrees of freedom, Harmonic motion, vectorial representation, complex number representation, addition
UNIT 2	Undamped Single Degree of Freedom System: Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy, Compound pendulum and centre of percussion. damping, under-damped, critically damped and over-damped systems Logarithmic decrement Vibration characteristics of Coulomb damped system and Vibration characteristics of Hysteretic damped systems.
UNIT 3	Forced Vibrations of Single Degree of Freedom Systems: Forced vibration with constant harmonic excitation, Steady state and transient parts, Frequency response curves and phase angle plot, Forced vibration due to excitation of support. Vibration Isolation and Transmissibility: Force transmissibility, Motion transmissibility, Forced vibration with rotating and reciprocating unbalance, Materials used in vibration isolation.
UNIT 4	System with Two Degrees of Freedom: principle mode of vibration, Mode shapes, Undamped forced vibrations of two degrees of freedom system with harmonic excitation, Vibration Absorber, Undamped

	dynamic vibration absorber and centrifugal pendulum absorber Critical Speed of Shaft: Critical speed of a light shaft without damping, critical speed of shaft having multiple discs, secondary critical speed.
UNIT 5	Many Degrees of Freedom Systems (Exact analysis): Equation of Motion, The matrix method, Eigen Values and Eigen Vectors, Method of influence Coefficients and Maxwell's reciprocal theorem. Torsional vibrations of multi rotor system, vibrations of geared system, Generalized coordinates and coordinate coupling Many Degrees of Freedom Systems (approximate methods): Rayleigh's, Dunkerley's, Stodola's and Holzer's methods Vibrations of continuous systems: Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft.

Text Books	
1	Mechanical Vibrations, SS Rao, Pearson
2	Mechanical Vibrations, GK Grover, Nem Chand Bros.
3	Ambekar A.G., "Mechanical Vibrations and Noise Engineering", Prentice Hall of India Pvt. Ltd.

6ME4-04: DESIGN OF MACHINE ELEMENTS- II

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End TermExam:3 Hours**

Course outcome	Details
CO364.1	Student will be able to understand the Fatigue Considerations in Design of Machine Elements and finite and infinite life for fluctuating and reversed stresses.
CO364.2	Student will be able to apply various designing technique for design piston, cylinder, Connecting road and crank shaft.
CO364.3	Students will be very familiar to analyze and design various types of Springs and Design of pulley drive system.
CO364.4	Students are able to evaluate various types of Gears design under different loading conditions.
CO364.5	Students are able to design of various types of bearings and selection of bearings.

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Fatigue Considerations in Design: Variable load, loading pattern, endurance stresses, Influence of size, surface finish, notch sensitivity and stress concentration. Goodman line, Soderberg line, Design of machine members Subjected to combined, steady and alternating stresses. Design for finite life, Design of Shafts under Variable Stresses, Bolts subjected to variable stresses.
UNIT 2	Design of IC Engine components: Piston, Cylinder, Connecting Rod and Crank Shaft.
UNIT 3	Design of helical compression, tension, torsional springs, springs under variable stresses. Design of belt, rope and pulley drive system,
UNIT 4	Design of gear teeth: Lewis and Buckingham equations, wear and dynamic load considerations. Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces.
UNIT 5	Design of Sliding and Journal Bearing: Methods of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium. Selection of anti-friction bearings for different loads and load cycles, Mounting of the bearings, Method of lubrication.

Text Books	
1	**Introduction to Machine Design, V.B. Bhandhari, McGraw Hill**
2	A Textbook of Machine Design, RS Khurmi, S.Chand Publications
3	Machine Design (ISBN: 9789382609575), Sadhu Singh, Khanna Publishing Hous

6ME4-05: QUALITY MANAGEMENT

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End TermExam:3 Hours**

Course outcome	Details
CO365.1	Student will able to explain the different meaning of quality concept, its influence and describe, distinguish and use the several techniques, quality management tools, probability and statistics application to quality engineering.
CO365.2	Student will able to analyze control charts like x-bar, R ,S for quality improvement and learn concept of SQC .
CO365.3	Student will able to Learn to use several Quality Improvement Tools like Histogram, charts, P- chart, np- chart, c- chart, u- chart and process capability. In addition they would get an introduction of six sigma
CO365.4	Students get acquainted with the concepts of Quality Assurance and their functioning. Including Quality Management Systems such as ISO 9000 and ISO 14000 series of quality.
CO365.5	Student will able to apply principles and techniques of reliability engineering and Taguchi method to predict product and system performance.

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. The meaning of Quality and quality improvement dimensions of quality, history of quality methodology, quality control, Quality of design and quality of conformance, Quality policy and objectives, Economics of quality. Modeling process quality: Describing variation, frequency distribution, continuous and discrete, probability distributions, pattern of variation, Inferences about process quality: sampling distributions and estimation of process parameters. Analysis of variance.
UNIT 2	Statistical Quality Control: Concept of SQC, Chance and assignable causes of variation, statistical basis of control chart, basic principles, choice of control limits, sample size and sampling frequency, analysis of patterns on control charts. The magnificent seven. Control chart for variables,: X-bar and R charts, X-bar and S charts, control chart for individual measurement. Application of variable control charts.
UNIT 3	Control chart for attributes: control chart for fraction non-conforming P-chart, np-chart, c-chart and u-chart. Demerit systems, choice between attribute and variable control chart. SPC for short production runs. Process capability analysis using histogram and probability plot, capability ratios and concept of six sigma.
UNIT 4	Quality Assurance: Concept, advantages, field complaints, quality rating, quality audit. Acceptance Sampling: Fundamental concepts in acceptance sampling,

	operating characteristics curve. Acceptance sampling plans, single, double and multiple sampling plans, LTPD, AOQL, AOQ. Introduction to Quality systems like ISO 9000 and ISO 14000.
UNIT 5	Reliability and Life Testing- Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations. Introduction to Availability and Maintainability Introduction to Taguchi Method of Design of Experiments, Quality loss function.

Text Books	
1	**Total Quality Management, Poonia& Sharma, Khanna Publishing House**
2	Total Quality Management, Gopal, PHI
3	Reliability Engineering, E. Balaguruswamy, Tata McGaw Hill
4	Industrial Maintenance Management, S.K. Srivastava, S.Chand& Co.

6ME5-12: NON CONVENTIONAL MACHINING METHODS

Credit: 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End TermExam:3 Hours**

Course outcome	Details
CO36612.1	Student will able to learn advanced machining process & Abrasive finishing processes .
CO36612.2	Student will able to learn Mechanical advanced machining process
CO36612.3	Student will able to learn Thermo electric advanced machining process
CO36612.4	Student will able to learn Electrochemical and chemical advanced machining process
CO36612.5	Students will have the knowledge of Micro and nanomachining.

UNIT	Syllabus
UNIT 1	Introduction: Objective, scope and outcome of the course. Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process. Abrasive finishing processes: AFM, MAF (for Plain and cylindrical surfaces).
UNIT 2	Mechanical advanced machining process: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM, USM, WJC.
UNIT 3	Thermo electric advanced machining process: Introduction, Principle, process parameters, advantages, disadvantages and applications about EDM, EDG, LBM, PAM, EBM
UNIT 4	Electrochemical and chemical advanced machining process: ECM, ECG, ESD, Chemical machining, Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process..
UNIT 5	Introduction to Micro and nanomachining, Introduction to Micro and nanomachining, Nanoscale Cutting, Diamond Tools in Micromachining, Conventional Processes: Microturning, Microdrilling and Micromilling, Microgrinding, Non-Conventional Processes: Laser Micromachining, Evaluation of Subsurface Damage in Nano and Micromachining, Applications of Nano and Micromachining in Industry.

Text Books	
1	Non-Traditional Machining by Mr. Omkar I K
2	“Modern Machining Process” by Pandey and Shah
3	“Nontraditional Machining Processes” by E Weller

6ME4-21 CIMS LAB.

Credit:1.5 **Max.Marks:75 (IA:45,ETE:30)** **0L+0T+3P**

Course outcome	Details
CO3621.1	Students will be learning part programming for plain turning operation
CO3621.2	Students will learn part program for threading operation.
CO3621.3	Students will learn part program for multiple drilling in X and Z axis using drilling
CO3621.4	Students will learn part program for threading operation.
CO3621.5	Students will learn part program for multiple drilling in X and Z axis using drilling

Content

SN	NAME OF EXPERIMENT
1	To prepare part programming for plain turning operation.
2	To prepare part program for turning operations using turning cycle.
3	To prepare part program for threading operation.
4	To prepare part program for gear cutting using mill cycle.
5	To prepare part program for multiple drilling in X and Z axis using drilling cycle.
	Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project. • Engraving of students' name, manufacturing of a part.

6ME4-22: VIBRATION LAB.

Credit:1.5 **Max.Marks:75 (IA:45,ETE:30)** **0L+0T+3P**

Course outcome	Details
CO3622.1	Students will learn simple & Compound pendulum
CO3622.2	Students will understand bifilar suspension &spring mass system.
CO3622.3	Students will be determining natural frequency of free torsional vibrations of single rotor system, damping co-efficient (free damped torsional vibration)forced vibration of cantilever beam.
CO3622.4	Students will be acknowledged trifler suspension,vibration measuring instruments
CO3622.5	Students will be able to analyze Forced Vibration of a Single DOF System.

Content

SN	NAME OF EXPERIMENT
1	To verify relation T = $2\pi\sqrt{}$ (l/g) for a simple pendulum.
2	To determine radius of gyration of compound pendulum.
3	To determine the radius of gyration of given bar by using bifilar suspension.
4	To determine natural frequency of a spring mass system.
5	Equivalent spring mass system.
6	To determine natural frequency of free torsional vibrations of single rotor system. i. Horizontal rotor ii. Vertical rotor
7	To verify the Dunkerley's rule.
8	Performing the experiment to find out damping co-efficient in case of free damped torsional vibration
9	To conduct experiment of trifler suspension.
10	Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.
11	Study of Vibration measuring instruments.
12	Perform study of the following using Virtual Lab http://www.vlab.co.in/
13	Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.
14	Harmonicaly Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.
15	Perform study of the following using Virtual Lab http://www.vlab.co.in/
16	Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.
17	Harmonicaly Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.
	Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project. • Design of vibration system, measurement of vibration, FFT analysis using MATLAB

6ME4-23: MACHINE DESIGN PRACTICE – II

Credit:1.5 **Max.Marks:75 (IA:45,ETE:30)** **0L+0T+3P**

Course outcome	Details
CO3623.1	Students will be learning fatigue loading& spring design
CO3623.2	Students will have knowledge of Belt, & Chain drive sytem.
CO3623.1	Students will learn bearing design & selection.
CO3623.2	Students will have knowledge of Belt, & Chain drive sytem.
CO3623.1	Students will learn bearing design & selection.

Content

SN	Name of Experiment
	Problems on:
	Use data hand book by Mahadevan and Reddy
1	Fatigue loading.
2	Helical compression, tension and torsional springs design.
3	Curved Beams.
4	Preloaded bolts and bolts subjected to variable stresses.
5	Belt, Rope and Chain drive system.
6	Gear Design.
7	Sliding contact bearing design.
8	Anti-friction bearing selection
	Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project. • Design of assembly (mechanical systems) using various BIS codes/data book

6ME4-24: THERMAL ENGINEERING LAB-1

Credit:1.5 **Max.Marks:100 (IA:60,ETE:40)** **0L+0T+3P**

Course outcome	Details
CO3624.1	Student will learn the working principle of four stroke petrol and diesel Engine.
CO3624.2	Student will learn the valve timing diagram of single cylinder diesel engine.
CO3624.3	Student will learn about the types of boilers and their mountings and accessories.
CO3624.4	Student will learn the steering system, its measurement and its impact on vehicle performance.
CO3624.5	Student will learn about the braking system and transmission system of automobiles.

Content

SN	Name Of Experiment
1	Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models
2	Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.
3	To draw valve timing diagram for a single cylinder diesel engine.
4	Study of various types of boilers.
5	Study of various types of mountings and accessories.
6	Demonstration of steering system and measurement of steering geometry anglesand their impact on vehicle performance.
7	Study of braking system with specific reference to types of braking system,master cylinder, brake shoes.
8	Study of transmission system including clutches, gear box assembly and differential box
	Important Note: • Study also includes Assembly and disassembly of above systems • It is mandatory for every student to present a term paper. Termpaper shall be a group activity. A group shall consist of maximumtwo students. Final evaluation shall include 30% weight age to term paper. Term paper shall cover study or survey of new technologies in above systems.

7ME5-11: I. C. ENGINES

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End TermExam:3 Hours**

Course outcome	Details
CO471.1	The student will be able to explain the history of IC engine , its testing and performance and how combustion takes place in CI and SI engine.
CO471.2	The student will be getting the knowledge of various kind of Alternatives fuel used in the IC engine, various components used In the Engine and technologies like CRDI and MPFI
CO471.3	Student will be able to explain engine lubrication system and ignition system of the automobiles.
CO471.4	Student will be able to explain the supercharging in automobiles and flex fuel engines.
CO471.5	Student will be able to explain special engines used in civil aviation.

UNIT	Syllabus
UNIT 1	**History of IC engines:** Nomenclature, Classification & Comparison, SI & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel-air cycles, Actual cycles.
	Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.
	Fuel & Combustion: Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of combustion chamber.
UNIT 2	**Alternative Fuels:** Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas.
	Engine Systems & Components: Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/Fmixture, Requirements of A/F ratios as per different operating conditions, Carburettors, types, Aircraft carburettor, comparison of carburetion & injection, F/A ratio calculations.
	CI engine: Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors.
UNIT 3	**Ignition system:** Conventional & Modern ignition systems Magnetov/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order,spark

	plugs.
	Engine Friction & Lubrication: Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.
UNIT 4	**Supercharging:** Objectives, Thermodynamic cycle & performance of super charged SI & CI engines, Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines construction & valve lining scavenging. Process parameters, systems, supercharging of 2 stroke engines.
	Dual & Multi fuel engines: Principle, fuels, Combustion, performance Advantages, Modification in fuel system.
UNIT 5	**Special Engines**: Working principles of Rotary, Stratified charge, Free piston, and Variable compression ratio engines.

Text Books	
1	**Mathur and Sharma, Internal Combustion Engines, Dhanpat Rai & Sons**
2	Gupta H.N., Fundamentals of Internal Combustion Engines, Prentice Hall ofIndia
3	F. EdwardObert, Internal Combustion Engines, Harper and Raw Publisher

7AN6-60.2: NON-DESTRUCTIVE TESTING

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End TermExam:3 Hours**

Course outcome	Details
CO472.1	Student will be introduced to overview of NDT & will get to know about Surface Non Destructive Evaluation (NDE) Methods in depth.
CO472.2	Student will understand Thermography and Eddy Current Testing (ET).
CO472.3	Students will be acknowledged with Ultrasonic Testing (UT) and Acoustic Emission (AE).
CO472.4	Student will be able to understand Radiography.
CO472.5	Student will be learning Special Techniques and Applications.

UNIT	Syllabus
UNIT 1	**Introduction**: Objective, scope and outcome of the course **Overview of NDT:** NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection, Unaided and aided.
UNIT 2	**Surface Non Destructive Evaluation (NDE) Methods:** Liquid Penetrant Testing, Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods. Testing Procedure, Magnetic Particle Testing, Theory of magnetism, inspection materials. Magnetisation methods, Interpretation and evaluation, Principles and methods of demagnetization, Residual magnetism.
UNIT 3	**Thermography and Eddy Current Testing (ET):** Thermography, Principles, Contact and non contact inspection methods, Advantages and limitation, Instrumentations and methods, applications. Eddy Current Testing, Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.
UNIT 4	**Ultrasonic Testing (UT) and Acoustic Emission (AE):** Ultrasonic Testing, Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-Scan, B-scan, C-scan. Acoustic Emission Technique, Principle, AE parameters, Applications.
UNIT 5	**Radiography (RT):** Principle, Interaction of X-Ray with matter, imaging, film and film less techniques, Types and use of filters and screens, Geometric factors, Inverse square, law, characteristics of films, Interpretation/ Evaluation, Fluoroscopy, Xero Radiography, Computed Radiography, Computed Tomography.
	Special Techniques and Applications: Phased array ultrasonics time of flight diffractions, Automated and remote ultrasonic testing, Acoustic pulse reflectometry, Alternative current field method, Case studies on NDT techniques used in aircrafts.

Text Books	
1	**Practical Non-Destructive Testing, Baldev Raj, T. Jay Kumar, M. Thavasimuthu, Narosa**

2	Basics of non- Destructive testing, Lari & Kumar, Katson Books
3	Non-destructive testing techniques, Ravi Prakash, new age science

7ME4-21: FEA LAB

Credit: 1.5 **Max. Marks: 75(IA: 45 ETE: 30)**

0L+0T+3P **End TermExam:3 Hours**

Course outcome	Details
CO4721.1	Student will learn the solution of solid mechanical problem, heat transfer problem and free vibration problems.
CO4721.2	Student will learn the GUI for NASTRAN,ANSYS , SIMULIA , ABACUS.
CO4721.3	Student will learn the analysis of beams and frames , plain stress and plain strain.
CO4721.4	Student will learn about the analysis of axisymmetric solids.
CO4721.5	Student will learn the problem analysis of 3-D solids.

Content

SN	Name of Experiments
1	Laboratory work for the solution of solid mechanics problems, heat transferproblems, and free vibration problems
A: by using FE packages such as NASTRAN/ANSYS/SIMULIA/ABAQUS	
2	Introduction of GUI of the software in the above mentioned areas' realisticproblems.
3	Analysis of beams and frames (bending and torsion problems)
4	Plane stress and plane strain analysis problems
5	Problems leading to analysis of axisymmetric solids
6	Problems leading to analysis of three dimensional solids (a) Heat transfer problems (b) Modal analysis problem
B: by writing own code for finite element analysis using MATLAB for:	
7	Plane stress and plane strain analysis problems
8	Modal Analysis problem

7ME4-22: Thermal Engineering Lab-II

Credit:1.5 **Max.Marks:75 (IA:45,ETE:30)** **0L+0T+3P**

Course outcome	Details
CO4722.1	Students will be able to test single cylinder diesel engine & a multicylinder petrol engine
CO4722.2	Students will analyse engine exhaust gases , refrigeration cycle ,mechanical heat pump & controls used in Refrigeration and Air conditioning system.
CO4722.3	Students will underatand Refrigeration equipments, automotive air conditioning system& will be able to determine dryness fraction of steam.
CO4722.4	Students will have knowledge of Simple Steam Turbine & Hydraulic turbines.

Content

SN	Name of Experiments
1	To perform constant speed load test on a single cylinder diesel engine and toplot performance curves: indicated thermal efficiency, brake thermal efficiency, mechanical efficiency Vs. Brake power and heat balance sheet.
2	To estimate the Indicated Power, Friction Power and Mechanical Efficiency of amulti-cylinder Petrol Engine. (Morse Test)
3	Analysis of engine exhaust gases using Orsat apparatus /Engine gas analyzer.
4	Determination of coefficient of performance of Refrigeration cycle and tonnagecapacity of refrigeration unit.
5	To determine the COP and tonnage capacity of a Mechanical heat pump.
6	To study various controls used in Refrigeration and Air conditioning system.
7	Study of commercial Refrigeration equipments like cooling towers, hermeticallysealed compressors, automotive swash plate compressor etc.
8	To study automotive air conditioning system.
9	Determination of dryness fraction of steam.
10	Study and Performance of Simple Steam Turbine
11	Performance characteristics of Hydraulic turbines.
12	Study and Performance of Gas Turbine Plant.
13	Performance characteristics of variable and rated speed centrifugal pump.

7ME4-23: Quality Control Lab

Credit:1 **Max.Marks:50(IA:30,ETE:20)** **0L+0T+2P**

Course outcome	Details
CO4723.1	Students will understand X bar , R Chart & P Chart.
CO4723.2	Students will learn C Chart & will establish control limits.
CO4723.3	Students will learn Operating characterstics Curve.
CO4723.4	Students will be able to solve problems using normal & poisson distribution.
CO4723.5	Students will be able to solve quality control problems using SPC software

Content

SN	Name of Experiments
1	Case study on X bar chart and R chart of an industrial process output andprocess capability analysis of the process. The charts are to be drawn and calculations of process capability analysis to be reported.
2	p Chart: (a) To verify the Binomial Distribution of the number of defective balls bytreating the balls with a red colour to be defective. (b) To plot a p -chart by taking a sample of n=20 and establish control limits
3	Case study on C-chart of a product and establish control limits.
4	Operating Characteristics Curve: (a) To plot the operating characteristics curve for single sampling attribute planfor n = 20; c = 1, 2, 3. Designate the red ball as defective. (b) To compare the actual O.C. curve with theoretical O.C. curve usingapproximation for the nature of distribution
5	Distribution Verification: (a) To verify Normal Distribution using the experimental setup. (b) To find the distribution of numbered cardboard chips by random drawingone at a time with replacement. Make 25 subgroups in size 5 and 10 find the type of distribution of sample average in each case. Comment on yourobservations
6	To carry out verification of Poisson distribution using experimental set up.
7	Central Limit Theorem: (a) To show that a sample means for a normal universe follow a normal distribution (b) To show that the sample means for a non normal universe also follow a normal Distribution.
8	Solve quality control problems using SPC software like STATGRAPHICS/MINITAB/SIGMA XL /SYSTAT/EXCEL etc.

	Important Note: It is mandatory for every student to undertake a Case Study. The case study shall be of real problem involving quality issues preferably from local industry whose quality issues shall be solved using seven magnificent tools of SQC and other techniques of quality control. Case study shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to case study.

8ME5-12: SUPPLY AND OPERATIONS MANAGEMENT

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End Term Exam:3 Hours**

Course outcome	Details
CO481.1	Student will be introduced to the basic concepts of Operation management & operation strategy.
CO481.2	Student will understand Demand forecasting, its techniques and Product & sevice design.
CO481.3	Student will understand capacity planning & Facility location and its methods.
CO481.4	Student will learn basic techniques of production control and will aslo learn various planning levels of operation management.
CO481.5	Student will be envisioned with JIT, Scheduling techniques and Supply Chain Management.

UNIT	Syllabus
UNIT 1	**Introduction**: Objective, scope and outcome of the course. **Introduction to operations management (OM)**, the scope of OM; Historical evolution of OM; Trends in business; the management process. Operations Strategy, Competitiveness and Productivity
UNIT 2	**Demand Forecasting:** components of forecasting demand, Approaches to forecasting: forecasts based on judgment and opinion, Time series data. Associative forecasting techniques, Accuracy and control of forecasts, Selection of forecasting technique. **Product and Service** design, Process selection, Process types, Product and process matrix, Process analysis. Capacity Planning: Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis.
UNIT 3	**Facility Location:** Need for location decisions, factors affecting location, qualitative and quantitative techniques of location. Facilities layout: Product, Process, Fixed position, combination and cellular layouts; line balancing. Material Handling Facilities layout: Product, Process, Fixed position, combination and cellular layouts; line balancing. Material Handling Planning levels: long range, Intermediate range and Short range planning, Aggregate planning: Objective, Strategies, and techniques of aggregate planning. Master scheduling; Bill of materials

UNIT 4	MRP; inputs processing and outputs, and overview of MRPII , use of MRP to assist in planning capacity requirements, Introduction to ERP Techniques of production control in job shop production, batch production and mass production systems. sequencing: priority rules, sequencing jobs through two work centers, scheduling services
UNIT 5	Introduction to Just-in time (JIT) and Lean Operations: JIT production, JIT scheduling, synchronous production, Lean operations system Supply Chain Management (SCM): Need of SCM, Bullwhip effect, Elements of SCM, Logistics steps in creating effective supply chain, Purchasing and supplied management.

Text Books	
1	Roberta S. Russell, Bernard W. Taylor, Operations Management, John Wiley
2	Joseph S. Martinich, Production And Operations Management, John Wiley
3	S.N. Chary, Production and Operations Management, Tata McGraw Hill
4	Norman Gaither, Greg Frazier, Operations Management, Thomson Learning

8MI6-60.2: Maintenance Management

Credit: 3 **Max. Marks: 150(IA: 30, ETE: 120)**

3L+0T+0P **End Term Exam:3 Hours**

Course outcome	Details
CO482.1	Student will be able to understand the Organization and administration of maintenance systems
CO482.2	Student will clearly understand Failure Analysis along with Classification of maintenance systems
CO482.3	Students will be learning concepts of Cost management for maintenance & Decision models for maintenance planning
CO482.4	Students will understand Replacement vs. reconditioning, economics of overhaul ,planning horizon procedure &Spare planning and control
CO482.5	economical and operational aspects; computerization of maintenance activities, major plant shut-down procedures

UNIT	Syllabus
UNIT 1	**Introduction**: Objective, scope and out come of the course. **Introductio**n:Generalobjectives,Functions;Organizationandadministrationofmaintenancesystems;Requirements,Concepts and structure of suitable organizations for maintenance systems
UNIT 2	Failure Analysis: Analysis for source identification, classification land selectivity of failure; Statistical and reliability concepts and models for failure analysis Classification of maintenance systems; Basis and models for various maintenance systems
UNIT 3	Cost management for maintenance: cost estimates- recording, summarizing and distributing cost data, maintenance budget Decision models for maintenance planning; Operation and control, optimum level of maintenance; replacement aspects of breakdown and preventive types, group and individual types, obsolete facility, deteriorating and completely failing facilities
UNIT 4	Replacement vs. reconditioning, economics of overhaul, addition replacement model-additive damage case, zero memory case, partially observed situation, planning horizon procedure Spare planning and control: static spares, insurance spares with and without salvage value, low moving spares;man power planning-crew size , allocation etc. stand by machines
UNIT 5	Economical and operational aspects; scheduling planning of activities, monitoring and updating, resource allocation, Assigning priorities. Other relevant topics: work measurement for maintenance, maintenance control indices, maintenance service contract, preventive maintenance management-guidelines, procedure, general management of lubrication system Organizing preventive maintenance program using vibration signature analysis-some basic ideas, management of records for maintenance, computerization of maintenance activities, major plant shut-down procedures

Text Books	
1	**Effective Maintenance Management: Risk and Reliability Strategies for Optimizing Performance by Vee Narayan**
2	Engineering Maintenance Management (Industrial Engineering: A Series of Reference Books and Text Book 18) 2nd Edition, Kindle Edition by Benjamin W. Niebel
3	Maintenance Engineering and Management Kindle Edition by K. Venkataraman
4	Effective Maintenance Management: Risk and Reliability Strategies for Optimizing Performance by Vee Narayan

8ME4-21: INDUSTRIAL ENGINEERING LAB

Credit:1 **Max.Marks:50 (IA:30,ETE:20)** **0L+0T+2P**

Course outcome	Details
CO4821.1	Students will be able to learn usage of time study , flow process & Operation process chart
CO4821.2	Students will be analysing Inventory using ABC Analysis
CO4821.3	Students will be able to prepare BOM & POR.
CO4821.4	Students will be performing case study on sales forecasting & Project Management
CO4821.5	Students will be performing case study on Plant location & capacity planning

Content

SN	Name of Experiments
1	Determination of time standard for a given job using stopwatch time-study.
2	Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
3	Study of existing layout of a workstation with respect to controls anddisplays and suggesting improved design from ergonomic viewpoint.
4	To perform ABC analysis for the given set of inventory data.
5	To develop Bill of Materials/Product structure tree and calculate plannedorder release (POR) using MRP format
6	To solve the operations research problems on Linear programming/Transportation/Assignment etc. using OR software's like TORA/LINGO/LINDO/SAS/EXCEL SOLVER etc.
7	Simulation of inventory system/Queuing system/production system using Monte-Carlo method.
8	To perform case study on sales forecasting.
9	To perform case study on project management using PERT/CPM.
10	To perform a case study on plant location and layout planning.
11	To perform a case study on capacity planning.

8ME4-22: METROLOGY LAB

Credit:1 **Max.Marks:50 (IA:30,ETE:20)** **0L+0T+2P**

Course outcome	Details
CO4822.1	Students will learn measuring tools , measuring gaps & measurement of angle.Students will also learn surface roughness instrument.
CO4822.2	Students will be learning gear tooth measurement ,determing diameter of external thread
CO4822.3	Studentswill be plotting composite errors of gears
CO4822.4	Students will measure coating thickness
CO4822.5	Students will be able to check accuracy of a ground, machined and lapped surface & will be

Content

SN	Name of Experiments
1	Study of various measuring tools like dial gauge, micrometer, vernier caliperand telescopic gauges.
2	Measurement of angle and width of a V-groove by using bevel protector.
3	To measure a gap by using slip gauges
4	Measurement of angle by using sine bar.
5	Study and use of surface roughness instrument (Taylor Hobson make) Inspection of various elements of screw thread by Tool makers microscopeand optical projector.
6	Measurement of gear tooth thickness by using gear tooth vernier caliper.
7	To check accuracy of gear profile with the help of profile projector.
8	To determine the effective diameter of external thread by using three-wiremethod.
9	To measure flatness and surface defects in the given test piece with the helpof monochromatic check light and optical flat.
10	To plot the composite errors of a given set of gears using composite geartester.
11	Measurement of coating thickness on electroplated part and paint coating onsteel and non-ferrous material using coating thickness gauge.