Bachelor of Technology (Mechatronics Engineering), KUK
Credit-Based w.e.f session 2025-26
***SCHEME OF STUDIES/EXAMINATIONS* (Semester–III)**

S. No.	Course No.	Course Title	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester Examination	Internal Assessment	Practical	Total	
1	#B24-BS-201A	Optics & Waves	3:1:0	4	4	70	30	0	100	3
2	B24-BS-204A	Higher Engineering Mathematics	3:1:0	4	4	70	30	0	100	3
3	#B24-ES-203A	Basic Electronics Engineering	3:1:0	4	4	70	30	0	100	3
4	B24-MTC-201	Thermal Engineering	3:0:0	3	3	70	30	0	100	3
5	B24-MTC-203	Applied Engineering Mechanics	3:1:0	4	4	70	30	0	100	3
6	B24-MTC-205	Theory of Machines-I	3:1:0	4	4	70	30	0	100	3
7	B24-ES-211LA	Basic Electronics Lab	0:0:2	2	1	0	40	60	100	3
8	B24-MTC-207	Applied Engineering Mechanics Lab	0:0:2	2	1	0	40	60	100	3
9	B24-MTC-209	Theory of Machines-I Lab	0:0:2	2	1	0	40	60	100	3
10	*B24-MC-901A	Environmental Sciences	3:0:0	3	1	70	30	-	100	3
		Total	21:5:6	32	27	490	330	180	1000	

Note:

*1. *B24-MC-901A is a mandatory credit-less course in which the students will be required to get passing marks in the Internal Assessment.*
2. Students are allowed to use programmable scientific calculator during examination.

Bachelor of Technology (Mechatronics Engineering), KUK
Credit-Based w.e.f session 2025-26
***SCHEME OF STUDIES/EXAMINATIONS* (Semester–IV)**

S No.	Course No.	Course Title	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester Examination	Internal Assessment	Practical	Total	
1	#B24-ES-204A	Materials Engineering	3:0:0	3	3	70	30	0	100	3
2	B24-MTC-202	Digital Electronics	3:1:0	4	4	70	30	0	100	3
3	B24-MTC-204	Fluid Mechanics and Heat Transfer	3:1:0	4	4	70	30	0	100	3
4	B24-MTC-206	Production Technology-I	3:1:0	4	4	70	30	0	100	3
5	B24-MTC-208	Theory of Machines-II	3:1:0	4	4	70	30	0	100	3
6	B24-MTC-210	Fluid Mechanics and Heat Transfer Lab	0:0:3	3	1.5	0	40	60	100	3
7	B24-MTC-212	Theory of Machines-II Lab	0:0:3	3	1.5	0	40	60	100	3
8	B24-MTC-214	Digital Electronics Lab	0:0:2	2	1	0	40	60	100	3
9	B24-MAC-202	Constitution of India	3:0:0	3	-	-	100	-	100	3
		Total	18:4:8	30	23	350	370	180	900	

Note:

1. **B24-MAC-202 is a mandatory credit-less course in which the students will be required to get passing marks in the Internal Assessment.*
2. *Students are allowed to use programmable scientific calculator during examination.*
3. *All the students have to undergo six weeks industrial training after 4th semester and it will be evaluated in 5th semester.*
4. *#The courses are common with B. Tech. Mechanical Engineering.*

B24-BS–201A	Optics and Waves						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hours)**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3**
Purpose	**To introduce the fundamentals of wave and optics for the applications in Engineering field.**						
Course Outcomes							
CO 1	**Familiarize with basic phenomenon used in propagation of waves.**						
CO 2	**Introduce the fundamentals of interference, diffraction, polarization and their applications.**						
CO 3	**To make the students aware to the importance of Laser in technology.**						

Unit - I

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and Bandwidth, Group velocity and real light waves.

Propagation of light waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free-space, Uniform plane waves, Wave polarization, Energy density, the pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: law of reflection, Snell's law and reflection coefficients.

Unit - II

Interference: Principle of Superposition, Conditions for Sustained interference, Young's double slit experiment, Division of wave-front: Fresnel's Biprism and its applications, Division of amplitude: Interference due to reflected and transmitted light, Wedge-shaped thin film, Newton's rings and its applications, Michelson Interferometer and its applications.

Unit – III

Diffraction: Types of diffraction, Fraunhofer diffraction at a single slit, Plane transmission diffraction grating: theory, secondary maxima and secondary minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Dispersive power and resolving power of diffraction grating.

Polarization: Polarization of transverse waves, Plane of polarization, Polarization by reflection, Double refraction, Nicol Prism, Quarter and half wave plate, Specific Rotation, Laurent 's half shade polarimeter, Biquartz polarimeter.

Unit – IV

Laser: Stimulated Absorption, Spontaneous and Stimulated Emission; Einstein's Coefficients and its derivation, Population Inversion, Direct and Indirect pumping, Pumping schemes, Main components of Laser, Gas lasers (He-Ne, CO_2), Solid state lasers (Ruby, Neodymium, semiconductor), Dye laser, Characteristics of Laser, Applications of Laser.

Text/Reference Books:

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd*., *India*
2. N. Subrahmanyam, B. Lal, M.N. Avadhanulu, A Textbook of Optics, *S. Chand & Company Ltd*., *India.*
3. A. Ghatak, Optics, *McGraw Hill Education (India) Pvt. Ltd., India*.
4. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Lt., India.*

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B24-BS-204A	HIGHER ENGINEERING MATHEMATICS						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hours)**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3**
Purpose	**The objective of this course is to familiarize the prospective Engineers with Laplace Transform, partial differential equations which allow deterministic mathematical formulations of phenomena in engineering processes and to study numerical methods for the approximation of their solution. More precisely, the objectives are as under:**						
Course Outcomes							
CO 1	**Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.**						
CO 2	**To introduce the Partial Differential Equations, its formation and solutions for multivariable differential equations originated from real world problems.**						
CO 3	**To introduce the tools of numerical methods in a comprehensive manner those are used in approximating the solutions of various engineering problems.**						
CO 4	**To familiar with essential tool of Numerical differentiation and Integration needed in approximate solutions for the ordinary differential equations.**						

UNIT-1

Laplace Transform

Laplace Transform, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ODEs by Laplace Transform method.

UNIT-2

Partial Differential Equations

Formation of Partial Differential Equations, Solutions of first order linear and non-linear PDEs, Charpit's method, Solution to homogenous linear partial differential equations (with constant coefficients) by complimentary function and particular integral method.

UNIT-3

Numerical Methods-1

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT-4

Numerical Methods-2

Numerical Differentiation using Newton's forward and backward difference formulae, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, 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.

Textbooks/References:

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993. AICTE Model Curriculum in Mathematics.

2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
4. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
8. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
9. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
10. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
11. Erwin Kreyszig and Sanjeev Ahuja, Applied Mathematics-II, Wiley India Publication, Reprint, 2015.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B24-ES-203A	Basic Electronics Engineering						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose :	To provide an overview of electronic devices and components to Mechanical engineering students.						
Course Outcomes							
CO 1	To introduce the basic electronics devices along with their applications.						
CO 2	To become familiar with basic operational amplifier circuits with applications and oscillators.						
CO 3	To understand the fundamentals of digital electronics.						
CO 4	To become familiar with basic electroniccommunication system.						

UNIT-I

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-Icharacteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. BJT structure, its input-output and transfer characteristics, BJT as a Common Emitter amplifier, frequency response and bandwidth.

UNIT-II

Operational amplifier and its applications: Introduction to operational amplifiers, inverting, non-inverting and differential modes, basic parameters of Op-amp, Op-amp in open loop configuration, study of practical op-amp IC 741, Op-amp applications: adder, subtractor, scale changer, averaging amplifer,comparator, integrator and differentiator.

Timing Circuits and Oscillators: IC 555 Duration of Exam (Hours)r pin diagram: Astableand mono-stable operation, Barkhausen's criteria for oscillations, R-C phase shift and Wein bridge oscillators using BJT and Op-Amp and their frequency of oscillation.

UNIT-III

Digital Electronics Fundamentals : Difference between analog and digital signals, Booleanalgebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- maps, Logic ICs, half and full adder, multiplexers, de-multiplexers, flip-flops, basic counters.

UNIT-IV

Electronic Communication Systems: The elements ofcommunication system,
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. Integrated Electronics, Millman&Halkias (Mc-Graw Hill)
2. Electronics Devices & Circuit Theory, RL Boylestead& L Nashelsky (PHI)

Reference Books:

1. Modern Digital Electronics, R P Jain, Tata McGraw Hill.
2. Electronic Communication Systems, G. Kennedy, McGraw Hill, 4th Edition

Note: The paper setter will set the paper as per the question paper templates provided.

B24-MTC-201	Thermal Engineering						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3**
Purpose	**To introduce the fundamentals of thermal engineering to the students for applications in Engineering field.**						
Course Outcomes							
CO 1	**Introduction of basic concepts of thermodynamics.**						
CO 2	**Introduction and application of laws of thermodynamics**						
CO 3	**Discussion on the concept of entropy.**						

UNIT I

Basic Concepts: Thermodynamics: Macroscopic and Microscopic Approach, Thermodynamic System and control volume, Thermodynamic properties processes and cycles, homogeneous and heterogeneous systems, thermodynamic equilibrium, quasi static process, work transfer, PdV work or displacement work, path function and point function, other types of work transfer, free expansion with zero work transfer, net work done by a system, heat transfer.

UNIT II

Zeroth Law of Thermodynamics and First Law of Thermodynamics: Zeroth law of thermodynamics. Comparison of thermometers, ideal gas, gas thermometers, Celsius temperature scale, electrical resistance thermometer, thermo couple1st law for a closed system undergoing a cycle, 1st law for a closed system undergoing a change of state, energy- a property of the system, different forms of stored energy, specific heat at constant volume, enthalpy, specific heat at constant pressure, energy of an isolated system, perpetual motion machine of the first kind (PMM1).

UNIT III

First Law applied to flow processes and Second Law of Thermodynamics: Control volume, steady flow process, mass balance and energy balance in a simple steady flow process, mass balance, energy balance, , some examples of steady flow process, nozzle and diffuser, throttling device, turbine and compressor, heat exchanger, Introduction to second law of thermodynamics, energy reservoirs, heat engines, Kelvin- Planck statement of second law, Clausius Statement for second law, refrigerator and heat pump, heat pump and electric resistance heater, equivalence of Kelvin-Plank and Clausius statements, reversibility and irreversibility, causes of reversibility, irreversibility due to lack of equilibrium, heat transfer through a finite temperature difference, lack of pressure equilibrium within the interior of the system or between the system and the surroundings, free expansion, irreversibility due to dissipative effects, friction, paddle wheel work transfer, transfer of electricity through a resistor, types of irreversibility, conditions for irreversibility.

UNIT IV

Entropy: Introduction, the inequality of Clausius, the property of entropy, temperature and entropy plot, entropy change in irreversible process, entropy principle, applications of entropy principle, transfer of heat through finite temperature difference, mixing of two fluids, maximum work obtainable from two finite bodies at temperatures T1 and T2. Maximum work obtainable from a finite body and a TER, processes exhibiting external mechanical irreversibility, isothermal dissipation of work, adiabatic dissipation of work, entropy transfer with heat flow.

TEXT BOOKS:

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill

REFERENCE BOOKS:

1. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
2. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew Y. R. Longman

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B24-MTC-203	Applied Engineering Mechanics						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose	**To understand the basic concepts and principles of mechanics and their applications to solve engineering problems.**						
Course Outcomes							
CO 1	**To understand the basic concepts of mechanics and various forces applied in engineering problems.**						
CO 2	**To study various types of forces like co-planar, parallel and concurrent forces.**						
CO 3	**To learn about the Moment of inertia, centroid and centre of gravity.**						
CO 4	**To study various types of dynamics of the engineering problems.**						

UNIT-I

Basic Concepts: Matter, Particle and body, space, time, motion and trajectory, Newtons laws of motion, scalar and vector quantities, Mass, Force and Weight, Tension and compression, System of forces, Equilibrium, Resultant and Equilibrant, Principle of transmissibility, Dimension and units, Dimensional Homogeneity.

Co-Planar Forces: Introduction, Parallelogram law of forces, resolution of forces, theorem of resolved parts, resultant of Coplanar-concurrent forces, triangle law of forces, polygon law of forces, free body diagram.

UNIT-II

Moment of force and Parallel Forces: Moment of a force, graphical representation of moment, varigon's theorem: law of moment, principle of moments, resultant of coplanar, Non-concurrent force system, parallel forces, couple, general conditions of equilibrium.

Lifting Machines:

Basic concepts and Definitions, Reversible and irreversible Machine, Law of Machine, Levers, Pulleys: Fixed and Movable, System of Pulleys, Simple wheel and axle, Differential wheel and axle, differential pulley block, winch crabs, inclined plane, screw jack, differential screw jack, worm amd worm wheel.

UNIT-III

Centre Points: Centroid and centre of Gravity

Centre of gravity and centroid, location of centroid/centre of gravity, Pappus-Guldinus Theorem.

Moment of Inertia: Area and Mass

Moment of Inertia and Radius of gyration, Moment of Inertia of lamina of different shapes, Mass moment of Inertia, Mass moment of inertia for specified cases, product of inertia, Principal axis and principal moment of inertia.

UNIT-IV

Projectiles:

Terms related to projectile motion, equation of projectile path, projection on an inclined plane.

Impulse, Momentum, Work and Energy: Force, impulse and momentum, motion of lift, motion of connected bodies, D'Alembert's Principle, Work, Power and Energy, Work-Energy Principle, Conservation of Mechanical Energy, Hamilton's Principle, Work done by a spring.

Text Books:

1. Engineering Mechanics (statics and Dynamics) By Dr. D.S. Kumar, S.K.Kataria & Sons.
2. Engineering Mechanics, D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi
3. Engineering Mechanics, R. S. Khurmi, S.Chand Publishing
4. A Textbook of Engineering Mechanics, R.K. Bansal, Laxmi Publications
5. Engineering Mechanics, Sharma, Pearson

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B24-MTC-205	Theory of Machines-I						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose	**To study and understand about basic elements and mechanisms used in machines.**						
Course Outcomes							
CO 1	**Discussions an simple mechanisms and their applications**						
CO 2	**Understand and learn about velocity and acceleration determination in mechanisms**						
CO 3	**Discussions on Simple harmonic motion and its applications**						
CO 4	**Learn and understand about friction and power transmission**						

UNIT I

Simple Mechanisms: Introduction, kinematic link or element, types of links, structure, difference between a machine and a structure, kinematic pair, types of constrained motions, classification of kinematic pairs, kinematic chain, types of joint in a chain, mechanism, number of degrees of freedom for a plane mechanism, application of Kutchbach criterion for plane mechanism, Grubler's criterion for plane mechanism, inversion of mechanism, types of kinematic chain, four bar chain or quadric cycle chain, inversion of four bar chain, single slider crank chain, double slider crank chain, inversions of double slider crank chain.

Velocity in mechanisms: Relative velocity methods, introduction, relative velocity of two bodies moving in straight lines, motion of a link, velocity of a point on a link by relative velocity method, velocities in slider crank mechanism, rubbing velocity at a pin joint, forces acting in a mechanism, mechanical advantage.

UNIT II

Acceleration in mechanisms: introduction, acceleration diagram, acceleration of a point on a link, acceleration in the slider crank mechanism, Cariole's component of acceleration.

Simple Harmonic Motion: Introduction, Velocity and Acceleration of a Particle Moving with Simple Harmonic Motion, Differential Equation of Simple Harmonic Motion, Terms Used in Simple Harmonic Motion, Simple Pendulum, Laws of Simple Pendulum, Closely-coiled Helical Spring. Compound Pendulum, Centre of Percussion, Bifilar Suspension, Trifilar Suspension (Torsional Pendulum).

UNIT III

Mechanism with lower pairs: Introduction, pantograph, straight-line motion mechanisms, exact straight line motion mechanisms made up of turning pairs, Peaucellier mechanism, Hart's mechanism, exact straight line motion consisting of one sliding pair Scott-Russell's mechanism, approximate straight line motion mechanisms, Watt's mechanism, modified Scott Russel mechanism, Grasshopper mechanism, Tchebicheff's mechanism, Roberts mechanism, straight line motions of engine indicators, Simplex indicator, cross-by-indicator, Thompson indicator, Dobbie Mc Innes indicator, Steering gear mechanism, Davis steering gear, Ackerman steering gear, Universal or Hooke's joint, ratio of shaft velocities, maximum and minimum speeds of driven shaft, condition for equal speeds of the driving and driven shafts, angular acceleration of the driven shaft, maximum fluctuation of speed, double Hooke's joint.

Friction: Introduction, Types of friction, friction between un-lubricated surfaces, friction between lubricated surfaces, limiting friction, laws of static friction, laws of kinetic or dynamic friction, laws of solid friction, laws of fluid friction, coefficient of friction, limiting angle of friction, angle of repose, minimum force required to slide a body on a rough horizontal plane, friction of a body lying on a rough

inclined plane, efficiency of a inclined plane, screw friction, screw jack, torque required to lift the load by a screw jack, torque required to lower the load by a screw jack, efficiency of a screw jack, maximum efficiency of a screw jack, over hauling and self locking screws, efficiency of a self locking screws, frction of a V thread, friction in journal bearing-friction circle, friction of pivot and collar bearing, flat pivot bearing, conical pivot bearing, trapezoidal or truncated conical pivot bearing, flat collar bearing, friction clutches, single disc or plate clutch, multiple disc clutch, cone clutches, centrifugal clutch,

UNIT IV

Belt rope and chain drives: Introduction, selection of a belt drive, types of belt drives, types of belts, types of belt drives, velocity ratio of belt drive, velocity ratio of compound belt drive, slip of belt, creep of belt, length of an open belt drive, length of crossed belt drive, power transmitted by a belt, ratio of driving tensions for flat belt drive, determination of angle of contact, centrifugal tension, maximum tension in the belt, condition for the transmission of maximum power, initial tension in the belt, V belt drive, advantages and disadvantages of V belt drive over the flat belt drive, ratio of driving tension for V belt, rope drive, fiber ropes, advantages of fiber rope drives, sheaves for fiber ropes, wire ropes, ratio of driving tensions for a rope drive, chain drives, advantages and disadvantages of chain drive over belt or rope drive, terms used in chain drive, relation between pitch and pitch circle diameter, relation between chain speed and angular velocity of sprocket, kinematic of chain drive, classification of chains, hoisting and hauling chains, conveyor chains, power transmitting chains, length of a chain.

TEXT BOOKS & REFEENCES:

1. Theory of machines: S. S. Rattan, Tata McGraw HillPublications
2. Theory of machines : R S Khurmi, S Chand Publications
3. Theory of Mechanism and Machines: JagdishLal, Metropolitan BookCo.
4. Mechanism synthesis and analysis: A.H. Soni, McGraw HillPublications.
5. Mechanism: J.S.Beggs.
6. Mechanics of Machines: P.Black, PergamonPress.
7. Theory of Machines: P.L.Ballaney, KhannaPublisher.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B24-ES-211LA	Basic Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credits**	**Internal Assessment**	**Practical**	**Total**	**Duration of Exam (Hours)**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose	**To give hands on experience to students with electronic devices**						
	Course Outcomes						
CO1	To introduce students with CRO						
CO2	To familiarize students with characteristics of Diode and transistor						
CO3	To implement Zener diode as a voltage regulator						
CO4	Measurement of displacement using LVDT						

LIST OF EXPERIMENTS

1. To study CRO
2. To plot the VI characteristics of PN junction diode
3. To plot the VI characteristics of Zener diode.
4. To study the half and full wave rectifier
5. To study the Bridge rectifier.
6. To plot the VI characteristics of transistor in CB mode
7. To plot the VI characteristics of transistor in CE mode
8. To study Zener diode as a voltage regulator
9. To study RC oscillator
10. To study single stage CE amplifier
11. To study LVDT for linear displacement

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NOTE: A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

B24-MTC-207	Applied Engineering Mechanics Lab						
Lecture	**Tutorial**	**Practical**	**Credits**	**Internal Assessment**	**Practical**	**Total**	**Duration of Exam (Hrs.)**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose	**To understand the basic concepts and principles of mechanics and their applications to solve engineering problems.**						
Course Outcomes							
CO 1	**Learn and understand about centroid and mass moment of inertia**						
CO 2	**Understand application of triangle law and polygon law of forces and determine resultant force.**						
CO 3	**Understand application of SFD and BMD**						

List of Experiments

1. To verify law of moments using bell crank lever.
2. To verify triangle law and polygon law for coplanar forces.
3. To determine moment of inertia of flywheel using flywheel apparatus.
4. To determine Centroid for various shapes.
5. Determine mechanical advantage of a screw jack.
6. Study differential wheel and axle of an automobile.
7. Study shear force and bending moment for a beam under various types of loading.
8. Experiment to determine SFD and BMD for a beam under point loading.
9. Study stress strain diagrams for brittle and ductile materials.

Note: Student will be required to perform total of 8 experiments. 7 experiments will be from the below given list and rest experiments will be designed based upon the curriculum.

B24-MTC-209	Theory of Machines-I Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical**	**Total**	**Duration of Exam (Hrs.)**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose	**To study and understand about basic elements and mechanisms used in machines and demonstrate few of them.**						
Course Outcomes							
CO 1	**Discussions an simple mechanisms and their applications**						
CO 2	**Understand and learn about velocity and acceleration determination in mechanisms**						
CO 3	**Discussions on Simple harmonic motion and its applications**						
CO 4	**Learn and understand about friction and power transmission**						

LIST OF EXPERIMENTS

1. To determine the modulus of rigidity of the material of a closed coil helical spring and the stiffness of a spring
2. To determine the value of coefficient of friction for a given pair of surfaces using friction apparatus
3. To determine the modulus of rigidity of horizontal shaft
4. To determine experimentally the ratio of the cutting time to idle time (cutting stroke to idle stroke) of the crank and slotted lever (QRM)/ Whitworth and compare the result to theoretical values plot the following
    - θ v/s X (displacement of slider).
    - θ v/s velocity.
    - θ v/s Acceleration and to compare the values of velocities (Take angles θ =45˚, 90˚, 135˚, 225˚, 270˚ &335˚, ω = 1rad/s)
5. To determine the value of coefficient of friction between the screw and nut of the jack, while:
    - Raising the load
    - Lowering the load
6. To draw experimentally a curve of the follower-displacement v/s cam-angle. Differentiate the above curve to get velocity and acceleration plot and compare the values with those obtained analytically.
7. To determine the coefficient of friction between belt and pulley and plot a graph between $\log_{10} T_1/T_2$ v/s, θ.
8. To determine the displacement, velocities, & accelerations of the driven shaft of a Hooke's joint for a constant speed of the driver shaft.
9. Study of bifilar and trifilar suspension system
10. Study of the inversions of the single slider crank mechanism.

NOTE: Student will be required to perform total of 10 experiments. 7 experiments will be from the below given list and rest experiments will be designed based upon the curriculum.

B24-MC-901A	Environmental Sciences						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hours)**
3	**0**	**0**	**1**	**70**	**30**	**100**	**3**
Purpose	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
Course Outcomes (CO)							
CO1	The students will be able to learn the importance of natural resources.						
CO2	To learn the theoretical and practical aspects of eco system.						
CO3	Will be able to learn the basic concepts of conservation of biodiversity.						
CO4	The students will be able to understand the basic concept of sustainable development.						

UNIT 1

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

(a) Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.

(b) Water Resources: Use & over-utilization of surface & ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy Resources: Growing energy needs, renewable & non-renewable energy sources, use of alternate energy sources. Case studies.

(f) Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

UNIT II

Ecosystem-Concept of an ecosystem. Sturcture and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

UNIT III

Biodiversity and its conservation: Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

Environmental Pollution Definition: Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

UNIT IV

Social Issues and the Environment. From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressan drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

Suggested Books

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India.
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley , India

Note: The Examiner will be given the question paper template to set the question paper.

	B.Tech. (4th Semester)						
#B24-ES-204A	MATERIALS ENGINEERING						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3**
Purpose :	To understand internal structure- properties relationship of different types of materials and learn about Metallographic analysis and Characterization.						
Course Outcomes							
CO 1	To understand the Crystal structures and deformation mechanism in various materials.						
CO 2	To study various types of phase diagrams, TTT curve and Iron carbon diagram. To learn about different heat treatment processes.						
CO 3	To learn about the failure mechanisms like Creep and Fatigue and designation of materials.						
CO 4	To study Basics of Metallography and Basic Principle involved in the working of various types of Material characterization techniques.						

UNIT I

Crystallography: Review of Crystal Structure, Space Lattice, Co-ordination Number ,Number of Atomsper Unit Cell, Atomic Packing Factor; Numerical Problems Related to Crystallography.

Imperfection in Metal Crystals: Crystal Imperfections and their Classifications, Point Defects, Line Defects, Edge & Screw Dislocations, Surface Defects, Volume Defects.

Introduction to Engineering materials and Standard Materials Designation: Introduction to Engineering materials, Steel Terminology, Standard Designation System for Steels, Indian Standard specifications for steels as per BIS: Based on Ultimate Tensile Strength and based on Composition, AISI-SAE standard designation for Steels and Aluminium Alloys

UNIT II

Phase Diagrams: Alloy Systems, Solid solutions, Hume Rothery's Rules, Intermediate phases, Phase Diagrams, Gibbs Phase Rule, Cooling curves, The Lever Rule, binary phase diagrams, Applications of Phase Diagrams, Phase Transformation, Micro constituents of Fe-C system, Allotropic Forms of Iron ,Iron-iron carbide phase diagram, Modified Iron Carbon Phase Diagrams, Isothermal Transformation, TTT Curve,

Heat Treatment: Heat treatment of steels, Annealing, Normalising, Hardening, Tempering, Case Hardening, Ageing, Aus tempering and Mar tempering, Surface Hardening, Mass Effect, Equipments for Heat Treatment, Major Defects in Metals or Alloys due to faulty Heat treatment.

UNIT III

Deformation of Metal: Elastic and Plastic Deformation, Mechanism of Plastic Deformation, Slip; Critical Resolved Shear Stress, Twinning, Conventional and True Stress Strain Curves for Polycrystalline Materials, Yield Point Phenomena, Bauschinger Effect, Work Hardening.

Failure of Materials: Fatigue, Fatigue fracture, fatigue failure, Mechanismof Fatigue Failure, Fatigue Life calculations ,Fatigue Tests, Theories of Fatigue.

Creep: Creep Curve , Types of Creep, Factors affecting Creep, Mechanism of Creep, Creep Resistant Material, Creep Fracture, Cre ep Test, Stress Rupture test.

UNIT IV

Introduction to Metallography: Metallography, Phase analysis, Dendritic growth, Cracks and other defects Corrosion analysis, Intergranular attack (IGA), Coating thickness and integrity, Inclusion size, shape and distribution, Weld and heat-affected zones (HAZ), Distribution and orientation of composite fillers, Graphite nodularity, Intergranular fracturing

Materials Characterization Techniques: Characterization techniques suchas X-Ray Diffraction (XRD), Scanning Electron Microscopy, transmission electron microscopy, atomic force microscopy, scanning tunneling microscopy, Atomic absorption spectroscopy.

Text Books:

1. Material Science by S.L.Kakani, New Age Publishers.
2. The Science and Engineering of Materials, Donald R. Askeland , Chapman & Hall.
3. Fundamentals of Material Science and Engineering by W. D. Callister, Wiley.
4. FundamentalofLightMicroscopyandElectronicImagingbyDouglasB.Murphy, Kindle Edition 2001
5. Materials Science and Engineering, V. Raghvan
6. Phase Transformation in Metals and Alloys,D. A.Porter &K.E. Easterling

Reference Books:

7. Material Science by Narula, TMH
8. Metallographic Handbook by Donald C. Zipperian, Pace Technologies, USA.
9. Robert Cahn Concise Encyclopedia of Materials Characterization, SecondEdition:2nd Edition (Advances in Materials Science and Engineering) Elsevier Publication 2005.
10. Smart Materials and Structures by Gandhi and Thompson, Chapman and Hall.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-MTC-202	Digital Electronics						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hours)**
3	**1**	**-**	4	**70**	**30**	**100**	**3**
Purpose	**To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.**						
Course Outcomes							
CO 1	To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions						
CO 2	To introduce the methods for simplifying Boolean expressions						
CO 3	To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits						
CO 4	To introduce the concept of converters and memories						

UNIT I

Fundamental Concepts: NAND and NOR operations, Exclusive-OR and Exclusive-NOR, Boolean Algebra

Number Systems and Codes: Number Systems, Binary Number Systems, Signed Binary Numbers, Binary Arithmetic, 2's Complement Arithmetic, Octal Number Systesm, Hexadecimal Number System, Codes, Error detecting and correcting codes.

UNIT II

COMBINATIONAL LOGIC DESIGN: Standard representation for logic functions, K-map representation, Simplification using K-map, Minimization of logic functions specified/not specified in minterm/maxterms, Don't care conditions, Design Examples.

Multiplexer and their use in combinational design, Demultiplexers/decoders and their use in combinational design, Adders and their use as subtractors, BCD Arithmetic, Digital Comparators, Parity Generators/Checkers, Code Converters

UNIT III

SEQUENTIAL LOGIC DESIGN: Flip-flops - SR, JK, D, T Flip Flops, Excitation table, Clocked Flip Flop Design.

Registers, Applications of Registers – Ring Counter, Sequence Generator. Ripple or Asynchronous Counters, Synchronous Counters

UNIT IV

A/D and D/A Converters: Digital to Analog converters- Weighted Resistor, R-2R Ladder, Specifications of D/A Converters. Analog to digital Converters – Quantization and Encoding, Flash Type, Successive Approximation, Dual Slope A/D Converter.

Semi Conductor Memories – Memory Organisation and Operation, Classification and characteristics of Memories, Read-only Memory, Read and Write Memory

TEXT BOOKS

1. R P Jain, Modern Digital Electronics, 4th Edition, TMH

REFERENCES

1. Anand Kumar, Fundamental of Digital Circuits, 2nd Edition, PHI-2009
2. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus

B24-MTC-204	Fluid Mechanics and Heat Transfer						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose	To understand the basic concepts and principles of Fluid mechanics and Heat Transfer and their applications to solve engineering problems.						
Course Outcomes							
CO 1	To understand the basic concepts of fluid mechanics with properties of fluid.						
CO 2	To study various types of pressure and forces with their measurements.						
CO 3	To learn about the Thermal conduction and steady state conduction.						
CO 4	To study conduction with heat generation.						

UNIT-I

Properties of Fluids: Introduction, Properties of fluids, Viscosity, Thermodynamic properties, compressibility and bulk modulus, surface tension and capillarity, vapour pressure and cavitation.

Pressure and Its Measurements: Fluid pressure at a point, Pascal's Law, Pressure variation in a fluid at rest, Absolute, Gauge, atmospheric and Vacuum pressures, Measurement of pressure with manometers and mechanical gauges, Simple manometers, Differential manometers, Pressure at a point in compressible fluid with isothermal process, adiabatic process and temperature Lapse-Rate.

UNIT-II

Hydrostatic Forces on surfaces: Introduction, total pressure and centre of pressure, vertical plane surface sub-merged in liquid, horizontal plane surface sub-merged in liquid, inclined plane surface sub-merged in liquid, Curved surface sub-merged in liquid, total pressure and centre of pressure on lock gates.

Buoyancy and Floatation: Introduction, Buoyancy, Centre of Buoyancy, Meta-centre,Meta-centric height with analytical and Experimental method, conditions of equilibrium of a floating and submerged bodies with their stability, Oscillation (Rolling) of a floating body, Numerical.

UNIT-III

Basic concepts of Heat Transfer

Thermodynamic system and Surroundings, thermodynamic property, temperature, heat and thermal equilibrium, thermodynamics versus heat transfer, basic laws governing heat transfer, modes and basic laws of heat transfer, steady and unsteady heat transfer, significance of heat transfer.

Fourier equation and thermal conductivity

Fourier equation, thermal resistance, Thermal conductivity of materials, General Heat conduction equation with Cartesian, Cylindrical and Spherical coordinates with General one-dimensional conduction equation, initial and boundary conditions, guarded hot plate method.

UNIT-IV

Steady State Conduction:

Conduction though a lane wall, conduction through a composite wall, heat flow between surface and surroundings: cooling and heating of fluids, conduction through a cylindrical wall, multilayer cylindrical wall and sphere, shape factor, effect of variable conductivity, critical thickness of insulation, multi dimensional steady conduction: analytic solution, graphical method and finite difference method.

Conduction with heat generation: Plane wall with uniform heat generation, dielectric heating, cylinder with uniform heat generation in solid and hollow (with different cases) cylinder, heat transfer through the piston crown, nuclear fuel elements with and without cladding, sphere with uniform heat generation, hollow sphere with inside surface insulated.

Text Books:

1. A Textbook of Fluid Mechanics and hydraulic machine, R.K. Bansal, Laxmi Publications
2. Heat & Mas Transfer, Dr. D. S. Kumar, KATSON Books.
3. Fluid Mechanics, Sadhu Singh, Khanna Books, Delhi
4. Fluid Mechanics, Modi & Seth, Standard Publishers
5. Fluid Mechanics, Hydraulics and Hydraulic Machines, KR Arora, Standard Publishers Distributors
6. Fundamental of Heat and Mass Transfer, M.Thirumaleshwar, Pearson
7. Computational Heat Transfer and Fluid Flow, Murlidhar & Sunder Rajan, Narosa
8. Thermal Engineering, M.L. Mathur & F.S. Mehta, Jain Publications
9. A Course in Heat & Mass Transfer, V.M. Domkundwar, Dhanpat Rai & Co.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus

B24-MTC-206	Production Technology-I						
Lecture	Tutorial	Practical	Credits	End Semester Examination	Internal Assessment	Total	Duration of Exam (Hrs.)
3	1	0	4	70	30	100	3
Purpose	To introduce the fundamentals of processes adopted for machining of materials.						

Course Outcomes	
CO 1	Discussion on geometry of cutting tools and principles of metal cutting
CO 2	Learn and understand economics of metal cutting
CO 3	To know about jigs and fixtures and their application
CO 4	To know about various measuring devices and their applications.

UNIT I

Geometry of cutting tools and Principles of metal cutting: Introduction, classification of cutting tools, single point cutting tools, tool nomenclature systems, positive and negative rake tools, drill geometry, elements of machining, classical metal machining processes, chip formation and types of chips, basic mechanism of chip formation, forces on the chip, velocity relationships, theories on mechanics of metal cutting, due to Ernst- Merchant, Lee and Shaffer theory, Palmer and Oxley theory, thermal aspects of machining.

UNIT II

Theory of machinability & mechanics of Multi-Point cutting tools: Evaluation of machinability, tool life, tool life plots, types of tool failure, flank wear, variables influencing the tool failure, chip formation, cutting forces and power consumption, surface finish, economics of machining: Element of machining cost, analysis for optimum cutting speed, problems on economics of machining, tooling economics, machines economics and optimization. Milling cutters: conventional milling and climb milling, chip cross section in milling, power required in milling, forces and torque in drilling, power requirement in broaching.

UNIT III

Jigs and Fixtures & Tool layout for Turrets: Tool engineering, tool design, types of tools, usefulness of jigs and fixtures, principles of jigs and fixture design, locating and clamping, locating devices, types of clamping devices, drilling jigs: elements of a jig, elements of a milling fixtures, materials for Jigs and fixtures, economics of jigs and fixtures. Introduction, characteristics of turret lathes, difference between turret and capstan, main parts of turrets, universal chucking equipment, universal bar equipment.

UNIT IV

Linear and angular measurements and Comparators: Direct reading instruments, micrometers, differential micrometers, bench micrometers, Vernier calipers, Vernier height guage, slip gauges, measurement of angles, sprit level, auto- collimator, measurement of tapers, external taper, dovetail angle, comparator-mechanical comparator, dial guage, principle of mechanical comparator, electrical comparator, optical comparator, working principle of an optical comparator, optical flat as comparator, checking height of a component, pneumatic comparator, working principle of a pneumatic comparator.

TEXT BOOKS:

1. Production Engineering and Science: Dr. PC Pandey and Dr. CK Sharma, Standard publishers Distributors
2. Manufacturing science: Ghosh and Malik, E.W.Press

REFERENCE BOOKS:

1. Principles of metal cutting: Sen and Bhattacharya, New CentralBook.
2. Metal cutting principles: Shaw, MIT PressCambridge
3. Manufacturing analysis: Cook,Adisson-Wesley
4. Modern machining processes: Pandey and Shan, Tata McGraw HillPublications

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus

B24-MTC-208	Theory of Machines-II						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose	**To study and understand about basic elements and mechanisms used in machines.**						
Course Outcomes							
CO 1	**Discussion on geometry of cutting tools and principles of metal cutting**						
CO 2	**Learn and understand economics of metal cutting**						
CO 3	**To know about jigs and fixtures and their application**						
CO 4	**To know about various measuring devices and their applications.**						

UNIT I

Toothed wheels and gear trains: Introduction, friction wheels, advantages and disadvantages of gear drive, classification of toothed wheels, terms used in gears, condition for constant velocity ratio of toothed wheels-law of gearing, velocity of sliding of teeth, forms of teeth, cycloidal teeth, involute teeth, effect of altering the centre distance on the velocity ratio for involute teeth gears, comparison between involute and cycloidal gears, systems of gear teeth, standard proportions of gear systems, length of path of contact, length of arc of contact, contact ratio (or number of pairs of teeth in contact), interference in involute gears, minimum number of teeth on the pinion in order to avoid interference, minimum number of teeth on the wheel in order to avoid interference, minimum number of teeth on a pinion for involute rack in order to avoid interference, types of gear trains, simple gear train, compound gear train, design of spur gears, reverted gear train, epicyclic gear train, velocity ratio of epicyclic gear train (Sun and planet wheel), epicyclic gear train with bevel gears, torques in epicyclic gear trains.

UNIT II

Brakes and balancing of rotating masses: Introduction, materials for brake lining, types of brakes, single block or shoe brake, pivoted block or shoe brake, double block or shoe brake, simple band brake, differential band brake, band and block brake, internal expanding brake, braking of a vehicle, dynamometer, types of dynamometers, classification of absorption dynamometers, prony brake dynamometer, rope brake dynamometers, classification of transmission dynamometers, epicyclic-train dynamometers, belt transmission dynamometer-froude or throneycraft transmission dynamometer, torsion

Dynamometer, Bevis Gibson flash light torsion dynamometer.
Balancing of rotating masses, balancing of single rotating mass by a single rotating mass, balancing of single rotating masses by two masses rotating in different planes, balancing of several masses rotating in the same plane, balancing of several masses rotating in different planes.

UNIT III

Gyroscopic couple and precessional motion & automatic control: Precessional angular motion, gyroscopic couple, effect of gyroscopic couple on an aero plane, terms used in naval ship, effect of gyroscopic couple on naval ship during steering, effect of gyroscopic couple on naval ship during pitching, effect of gyroscopic couple on naval ship during rolling, stability of a four wheel drive moving in a curved path, stability of a two wheel vehicle taking a turn,

Introduction, open and closed lop control, terms used in automatic control of systems, types of automatic control systems, block diagram, lag in response, transfer function, overall transfer function, transfer function for a system with viscous damped output, open loop transfer function, closed loop transfer function.

UNIT IV

Longitudinal and transverse vibrations: Introduction, Terms Used in Vibratory Motion, Types of Vibratory Motion, Types of free Vibrations, Natural frequency of free Longitudinal Vibrations, Natural frequency of free Transverse Vibrations, Effect of Inertia of the Constraint in Longitudinal and Transverse Vibrations, Natural frequency of free Transverse Vibrations Due to a Point Load Acting Over a Simply Supported Shaft, Natural frequency of free Transverse Vibrations Due to Uniformly Distributed Load Over a Simply Supported Shaft, Natural frequency of free Transverse Vibrations of a Shaft fixed at Both Ends and Carrying a Uniformly Distributed Load, Natural frequency of free Transverse Vibrations for a Shaft Subjected to a Number of Point Loads.

TEXT BOOKS:

1. Theory of machines: S. S. Rattan, Tata McGraw HillPublications
2. Theory of machines : R S Khurmi, S Chand Publications

REFERENCE BOOKS:

1. Theory of Mechanism and Machines: JagdishLal, Metropolitan BookCo.
2. Mechanism synthesis and analysis: A.H. Soni, McGraw HillPublications.
3. Mechanism: J.S.Beggs.
4. Mechanics of Machines: P.Black, PergamonPress.
5. Theory of Machines: P.L.Ballaney, KhannaPublisher.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus

B24-MTC-210	Fluid Mechanics and Heat Transfer Lab						
Lecture	**Tutorial**	**Practical**	**Credits**	**Internal Assessment**	**Practical**	**Total**	**Duration of Exam (Hrs.)**
0	**0**	**3**	**1.5**	**40**	**60**	**100**	**3**
Purpose	**To understand various principles adopted in heat transfer and fluid mechanics**						
Course Outcomes							
CO 1	**To demonstrate and verify Bernoulli's principle**						
CO 2	**To practically determine pipe fitting losses and buoyant force**						
CO 3	**Learn the process of determination of heat flow in conduction and convection**						

LIST OF EXPERIMENTS

1. To verify Bernoulli's theorem experimentally
2. To determine friction losses in various types of pipe fittings
3. To calculate flow of fluid using orifice meter. Find out coefficient of discharge for the given orifice meter
4. To calculate the buoyant force using hydrostatic tank
5. To calculate heat flow rate in conduction through composite wall
6. To calculate heat transfer rate in convection using pin fin apparatus
7. Determine heat exchanger effectiveness.
8. To demonstrate Pascal's law.

NOTE: Student will be required to perform total of 8 experiments. 7 experiments will be from the below given list and rest experiments will be designed based upon the curriculum.

B24-MTC-212	Theory of Machines-II						
Lecture	**Tutorial**	**Practical**	**Credits**	**Internal Assessment**	**Practical**	**Total**	**Duration of Exam (Hrs.)**
0	**0**	**3**	**1.5**	**40**	**60**	**100**	**3**
Purpose	**To study and understand about basic elements and mechanisms used in machines.**						
Course Outcomes							
CO 1	**Learn about MOI and practically verify the same for flywheel**						
CO 2	**Learn and understand gyroscopic effect and whirling of shaft**						
CO 3	**Understand the working of transmission unit and braking of an automobile**						

LIST OF EXPERIMENTS

1. To determine experimentally, the moment of inertia of a flywheel and axle compare with theoretical values.
2. To find out critical speed experimentally and to compare the whirling speed of a shaft with theoretical values.
3. To find experimentally the Gyroscopic couple on motorized gyroscope and compare with applied couple.
4. To calculate the torque on a planet carrier and torque on internal gear using epicyclic gear train and holding torque apparatus.
5. To study the different types of centrifugal and inertia governors and demonstrate anyone.
6. To study the automatic transmission unit.
7. To study the differential types of brakes.
8. To find experimentally frequency of simple pendulum.

NOTE: Student will be required to perform total of 8 experiments. 7 experiments will be from the below given list and rest experiments will be designed based upon the curriculum.

B24-MTC-214	Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credits**	**Internal Assessment**	**Practical**	**Total**	**Duration of Exam (Hours)**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose	**To learn the basic methods for the design of digital circuits and systems.**						
Course Outcomes							
CO 1	**To Familiarization with Digital Trainer Kit and associated equipment.**						
CO 2	**To Study and design of TTL gates**						
CO 3	**To learn the formal procedures for the analysis and design of combinational circuits.**						
CO 4	**To learn the formal procedures for the analysis and design of sequential circuits**						

LIST OF EXPERIMENTS

1. Familiarization with Digital Trainer Kit and associated equipment.
2. Study of gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
3. Design and realize a given function using K-Maps and verify its performance.
4. To verify the operation of Multiplexer and De-multiplexer.
5. To verify the operation of Comparator.
6. To verify the truth table of S-R, J-K, T, D Flip-flops.
7. To design and verify the operation of 3-bit asynchronous counter.
8. Study of Encoder and Decoder.
9. Study of A/D Converter.
10. Study of D/A Converter

NOTE: Student will be required to perform total of 8 experiments. 7 experiments will be from the below given list and rest experiments will be designed based upon the curriculum.

B24-MAC-202	Essence of Indian Traditional Knowledge						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Examination**	**Internal Assessment**	**Total**	**Duration of Exam (Hrs.)**
3	**-**	**-**	**-**	**-**	**100**	**100**	**3**
Purpose: To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of the roots of the knowledge system, analyze and apply to their day-to-day life.							
Course Outcomes							
CO1	The students will be able to understand, connect and explain the basics of Indian traditional knowledge from a modern scientific perspective.						
CO2	The students will be able to understand Holistic Health using the Indian Knowledge System.						
CO3	The students will be able to Manage their thoughts and Emotions and will learn positivity, self-regulation, and control.						
CO4	The students will be able to Achieve Consciousness through Indian Knowledge System.						

UNIT1

Introduction to Indian Traditional knowledge: Define traditional knowledge, importance, kinds of traditional knowledge. Philosophical systems, Basics of Rajyoga and Karam yoga, Benefits of Rajyoga and Karamyoga.

UNIT2

Holistic Health using Indian Knowledge System: Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras. Physical, Mental, Emotional and Spiritual health using traditional knowledge.

UNIT3

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience,Self-regulation and self-control, optimism, self-esteem. Managing thoughts and Emotions with the help of Rajyoga. Achieving Powers for Self-Mastery.

UNIT4

Achieving Consciousness through Indian Knowledge System:Emotional intelligence, Indian approach to Psychology. Consciousness; levels, body-mind relationship, self-motivation, Self and Identity in modern Psychology and Indian thought., Spirituality and well-being.

Reference and Text Books:

Mahadevan, M., Bhat, V.R. & Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHILearning

Baumgardner,SR&Crothers,MK(2009).PositivePsychology.PrenticeHall/PearsonEducation.

Cornelissen, R.M., Misra G. & Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education. Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation.

Rajyoga Meditation Course, Thoughkart, Jaipur (Rajasthan), India.

Prakartik Swasthya Shastra, Publisher Natural Lifestyle

Note: The paper setter will set the paper as per the question paper templates provided.