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Name of Program: B Tech. (Railway Engineering)

Subject Code	Category	Subject Name	Teaching & Evaluation Scheme								
			Theory			Practical		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
BTME404		Machine Design -I	60	20	20	30	20	3	1	2	5

Course Educational Objectives (CEOs):

1. To understand the design methodology for machine elements.
2. To analyse the forces acting on a machine element and apply the suitable
3. design methodology.
4. To understand the various standards and methods of standardisation.
5. To apply the concept of parametric design and validation by strength analysis.

Course Outcomes (COs): Upon completion of this course students will be able to:

1. Analyze and select machine elements/components.
2. Know the applications of the various elements, materials used to make them, and methods used.
3. Integrate various machine elements and components into the design of a machine or mechanical system through a design project.
4. To apply various theories of failure to design.
5. To Ability to select the material and configuration of different machine elements under a variety of environmental and service conditions. These includes, Shafts, Screws, bolts and their types, power screws.

Syllabus

UNIT -I

Introduction to Design Process:

Introduction to Design process, traditional design methods, different design models, Problem formulation, Design considerations, engineering materials and processes and their selection, BIS designation of steels, Mechanical properties, Load determination, manufacturing considerations in design Factors Materials selection direct - Bending and Torsional stress equation Impact and Shock loading Stress concentration factor Size factor Surface limits factor, Factor of safety, Design stress Theories of failures Problems.

UNIT -II

Fatigue strength and design of springs:

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Variable and cyclic loads Fatigue strength S- N curve Continued cyclic stress Soderberg and Goodman equations, fatigue failure, design consideration in fatigue, classification and spring materials, Spring end formation, Design of helical compression springs, helical extension springs, torsion springs, laminated springs, Protective coatings, Equalized stress in spring leaves. Multi - leaf springs. Surge in springs, Nipping and shot peening.

UNIT -III

Shafts, keys and couplings:

Shafts design on strength basis, torsional rigidity basis, Design of hollow shafts, flexible shafts, ASME codes for shafts, Keys and cotter design, Flat, square keys, Splines, Rigid and flange couplings, Flexible couplings

UNIT -IV

Threaded and welded joints:

Forms of threads, basic types of screw fastenings, ISO metric screw threads, eccentrically loaded bolted joints, Torque requirement for bolt tightening, Fluctuations loads on bolted joints, fasteners, Joints with combined stresses. Power screws, Force analysis. Collar friction, Differential and compound screws design. Types and strength of weld joints subjected to bending and fluctuating loads, cotter and knuckle joints, welded joints, different types welded joints and their design aspects, welding inspection

UNIT V

Journal Bearing:

Types of lubrication, viscosity, hydrodynamic theory, design factors, temperature and viscosity considerations, Reynold's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers, Design of journal bearings, Rolling-element Bearings: Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

Text Books:

1. Bhandari.V.B. "Design of Machine elements", (2010) Tata Mc Graw Hill Book Co, Third Edition.
2. R.S.Khurmi, J.K.Gupta. "Machine Design", (2008) Eurasia Publishing House (Pvt.) Ltd.Revised Edition.

References:

1. Shingley J.E; Machine Design; TMH
2. Sharma and Purohit; Design of Machine elements; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher
5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma & Agrawal; Machine Design; Kataria & sons
7. Maleev; Machnine Design;

List of Experiments

Designing and sketching of components contained in the syllabus.

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			Theory			Practical		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
BTEE302		Electrical Measurement And Instrumentation	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):
To enable the students to learn in detail about the various instruments available for monitoring/measuring electrical parameters encountered in domestic / industrial applications.

Course Outcomes (COs):
After the successful completion of this course students will be able to

1. To test and calibrate ammeter, voltmeter, and Wattmeter and energy meter
2. Measure low, medium & high Resistances using suitable bridges.
3. Understand the operating principles of Energy and power meters.
4. Learn the measurement of magnetic parameters.
5. To select proper instrument for measurement various Electrical elements

Syllabus

UNIT-I
Electrical Measurements
Standards of Measurement & Errors, Review of indicating and integrating instruments: Voltmeter, Ammeter, Wattmeter, and Energy meter.

UNIT-II
Measurement of Resistance, Inductance and Capacitance
Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

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UNIT-III

Instrument Transformers

Current Transformer and Potential Transformer : construction, theory, phasor diagram, ratio and phase angle errors, testing and applications.

UNIT-IV

Electronic Measurements

Electronic voltmeter, multimeter, wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO; Spectrum & Wave analyzer. Digital counter, frequency meter, voltmeter, multimeter and storage oscilloscope.

UNIT-V

Instrumentation

Transducers, classification & selection of transducers, strain gauges, inductive & capacitive transducers, piezoelectric and Hall-effect transducers, thermisters, thermocouples, photo-diodes & photo-transistors, encoder type digital transducers, signal conditioning and telemetry, basic concepts of smart sensors and application. Data Acquisition Systems.

Text books

1. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
2. Electrical & Electronic Measurement & Instruments by A.K.Sawhney, Dhanpat Rai & Co

Reference Books:

1. Helfrick and Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice-Hall of India, Reprint 1988.
2. Jones, B.E., "Instrumentation Measurement and Feedback", Tata McGraw-Hill, 1986.
3. Golding, E.W., "Electrical Measurement and Measuring Instruments", 3rd Edition, Sir Issac Pitman and Sons, 1960.

List of Experiments:

1. Calibration of Energy meter.
2. Measurement of resistance using Wheat stone's bridge.
3. Measurement of Insulation resistance using Megger.
4. Measurement of Power in three phase circuit by two & three wattmeter method.
5. Measurement of inductance by Maxwell's bridge.
6. Measurement of inductance by Hay's bridge.
7. Measurement of capacitance by Owens's bridge, and De Sauty bridge.
8. Measurement of displacement using LVDT.
9. Measurement of temperature by RTD, and thermocouple.
10. Measurement of Phase difference and Frequency on C.R.O.

Experiments beyond syllabus

1. Measurement of motor speed (RPM) of motor using opto-coupler and encoder disk
2. Measurement of motor speed (RPM) of motor using proximity sensor.

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			Theory			Practical		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
BTEE301		Circuit Theory	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):
To introduce the students with the concept of circuit elements lumped circuits, waveforms, circuit laws and network reduction. To solve the electrical network using mesh and nodal analysis by applying network theorems, analyze the transient response of series and parallel A.C. circuits and to solve problems in time domain using Laplace Transform.

Course Outcomes (COs): Upon completion of this course students will be able to:

1. Apply the nodal and mesh methods of circuit analysis.
2. Apply linearity and superposition concepts to analyze RL, RC, and RLC circuits in time and frequency domains.
3. Express complex circuits in their simpler Thévenin and Norton equivalent forms.
4. Analyze circuits both in time and frequency domains.
5. Construct and make time and frequency domain measurements on elementary RL, RC, and RLC circuits.

Syllabus

UNIT I

Practical Voltage & current sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. Analysis of magnetically coupled circuits, Dot convention, coupling coefficient, tuned circuits, Series and parallel resonance, frequency-response of series and Parallel circuits, Q –factor, Bandwidth.

Network topology, concept of Network graph, Tree, Tree branch & link, Incidence matrix, cut set and tie set matrices, dual networks.

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UNIT II

Transient analysis- Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. Steady state analysis- Concept of phasor & vector, impedance & admittance,

UNIT III

Network Theorems for AC & DC circuits-Thevenins & Norton's, Superpositions, Reciprocity, Compensation, Substitution, Maximum power transfer, and Millman's theorem, Tellegen's theorem, problems with dependent & independent sources.

UNIT IV

Frequency domain analysis – Laplace transform solution of Integro-differential equations, transform of waveform synthesized with step ramp, Gate and sinusoidal functions, Initial & final value theorem, Network Theorems in transform domain

UNIT V

Network function & Two port networks – concept of complex frequency, Network & Transfer functions for one port & two ports, poles and zeros, Necessary condition for driving point & transfer function. Two port parameters – Z, Y, ABCD, Hybrid parameters, their inverse & image parameters, relationship between parameters, Interconnection of two ports networks, terminated two port networks.

Text Books:

1. A K Chakrabarti :Circuit theory: Dhanpat Rai

Reference Books:

1. M.E. Van Valkenburg, Network Analysis, (PHI)
2. F.F.Kuo, Network Analysis.
3. Mittal GK; Network Analysis; Khanna Publisher
4. Mesereau and Jackson; Circuit Analysis- A system Approach; Pearson.
5. Sudhakar & Pillai; Circuit & Networks- Analysis and Synthesis; TMH
6. Hayt W.H. & J.E. Kemmerly; Engineering Circuit Analysis; TMH

List of experiments:

1. Verification of Thevenin Theorem.
2. Verification of Superposition Theorem.
3. Verification of Reciprocity Theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Verification of Millman's Theorem.
6. Determination of Open Circuit parameters of a Two Port Network.
7. Determination of Short Circuit parameters of a Two Port Network.
8. Determination of A,B, C, D parameters of a Two Port Network
9. Determination of Frequency Response of RLC Series Circuit.
10. Determination of Frequency Response of RLC parallel Circuit.

Beyond Syllabus:

1. Analysis of step response of first order circuits.

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2. Introduction to PSPICE / TINA PRO.

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			Theory			Practical		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
BTME303		Material Strength	60	20	20	30	20	3	1	2	5

Course Educational Objectives (CEOs):

1. To gain knowledge of different types of stresses, strain and deformation induced in the mechanical components due to external loads.
2. To study the distribution of various stresses in the mechanical elements such as beams, shafts etc.
3. To study effect of various loading conditions of column and gain knowledge of theories of failure.

Course Outcomes (COs): Upon completion of this course students will be able to:

1. Define and memorize mechanical properties of material & select appropriate material for a given working Conditions.
2. Explain simple stresses, bending stress, shear stress, torsion stress, principle stresses, thin and thick cylinder, shaft, springs, columns and theories of failures.
3. Calculate and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behaviour of materials.
4. Design of shaft and pressure vessels.
5. Justify bending equation and torsion equation and use it to solve the numerical.

Syllabus

UNIT I

Introduction: Mechanical Properties, Stress- strain, uni-axial, bi-axial and tri-axial stresses, tensile & compressive stresses, shear stress, Stress Strain Diagram, Poission's Ratio, Modulus of elasticity, Modulus of rigidity, Bulk modulus, Factor of safety, Volumetric Strain, Deformation

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of tapering members, Deformation due to self-weight, bars of varying sections, composite sections, principle of superposition, strain energy.

UNIT II

Compound Stresses

Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two and three dimensional analysis, Thermal Stress and its applications, Stresses in thin walled pressure vessel.

UNIT III

Bending and Deflection:

Bending: pure bending, symmetric member, deformation and stress, bending of composite sections, eccentric axial loading, and shear stress in beams, Deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

UNIT IV

Torsion: Torsion of circular shafts-solid and hollow, stresses in shafts when transmitting power, Strength of Shaft of varying sections and composite shaft, combined bending and torsion, strain energy due to torsion.

UNIT V

Columns and Theories of Failure: Buckling load, Types of end conditions for column, Euler's column theory and its limitations, Rankine- Gordon Formula, Theories of failures: Maximum principal stress theory, Maximum principal strain theory, maximum shear stress theory; maximum strain energy theory, maximum shear strain energy theory; application of theories to different materials and loading conditions

Text Books:

1. Strength of Materials, Dr. R.K. Bansal, Lakshmi Publications, New Delhi.
2. Strength of Materials, Basavarajaiah and Mahadevappa, Khanna Publishers, New Delhi.
3. Mechanics of Materials, James M. Gere (5th Edition), Thomson Learning
4. Strength of Materials—S. Ramamrutham, Dhanpat Rai Pvt. Ltd.
5. Mechanics of Materials—S. S. Rattan, TMH Pvt. Ltd.

Reference Books:

1. Strength of Materials, Subramanyam, Oxford University Press, Edition 2005
2. Elements of Strength of Materials, Timoshenko and Young Affiliated East-West Press
3. Strength of Materials, Singer Harper and Row Publications
4. Mechanics of Structures—S. B. Junnarkar, Charotar Publication.
5. Mechanics of Materials, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi.
6. Strength of Materials—W. Nash, Schaum's Outline Series, McGraw Hill Publication.

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7. Strength of Materials, S.S. Bhavikatti, Vikas Publishing House Pvt Limited.

List of Experiment:

1. Perform Brinell and Rockwell Hardness tests to find BHN and RHN for given specification.
2. Perform Izod/ Charpy impact test.
3. Perform Fatigue test
4. Perform Torsion test
5. To find tensile strength of given specimen by tensile test on MS and CI using UTM
6. Perform Direct/cross Shear test on MS and CI by UTM

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			Theory			Practical		L	T	P	Credits
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
ML301	Compulsory	Environment and Energy Studies	60	20	20	-	-	4	-	-	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

CourseObjectives: The students will be able to:

1. To understand sources of information required for addressing environmental challenges
2. To identify a suite of contemporary tools and techniques in environmental informatics
3. To apply literacy, numeracy and critical thinking skills to environmental problem-solving

Course Outcomes: The students should be able to:

1. Apply the principles of ecology and environmental issues that apply to air, land and water issues on a global scale.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community.

Syllabus

Unit I

Environmental Pollution and Control Technologies: Environmental Pollution & Control: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and industrial pollution, Ambient air quality standards. Water pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid Waste management composition and characteristics of e - Waste and its

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management. Pollution control technologies: Wastewater Treatment methods: Primary, Secondary and Tertiary.

Unit II

Natural Resources: Classification of Resources: Living and Non - Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problem, Mineral resources: use and exploitation, environmental effects of extracting and using mineral resouces, Land resources: Forest resources, Energy resources: growing energy needs, renewable energy source, case studies..

Unit III

Ecosystems: Definition, Scope and Importance ecosystem. Classification, Structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Energy flow in the ecosystem, Biogeochemical cycles, Bioaccumulation, ecosystem value, devices and carrying capacity, Field visits.

Unit IV

Biodiversity and its Conservation: Introduction - Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - . Biodiversity at global, National and local levels. - . India as a megadiversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, manwildlife conflicts; Conservation of biodiversity: In-situ and Exsitu conservation. National biodiversity act.

Unit V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan(EMP)

Suggested Readings:

1. Agarwal, K.C.,(latest edition).**Environmental Biology**, Bikaner :Nidi Pub. Ltd.,
2. Brunner R.C.(latest edition) **Hazardous Waste Incineration,** McGraw Hill Inc.
3. Clank R.S. .,(latest edition. **Marine Pollution**, Clanderson Press Oxford (TB).
4. **Environmental Encyclopedia**, Jaico Pub. Mumbai,
5. De A.K(latest edition) **Environmental Chemistry**, Wiley Wastern Ltd.
6. ErachBharucha(2005).**Environmental Studies for Undergraduate Courses** by for University Grants Commission.

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7. R. Rajagopalan(2006).**Environmental Studies**. Oxford University Press.
8. M. AnjiReddy(2006).**Textbook of Environmental Sciences and Technology**. BS Publication.
9. Richard T. Wright(2008).**Enviromental Science: towards a sustainable future** PHL Learning Private Ltd. New Delhi.
10. Gilbert M. Masters and Wendell P. Ela .(2008).**Environmental Engineering and science**. PHI Learning Pvt Ltd.
11. Daniel B. Botkin& Edwards A. Keller(2008).**Environmental Science** Wiley INDIA edition.
12. AnubhaKaushik(2009).**Enviromental Studies**. New age international publishers.

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