RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES BASAR

B.Tech in Mechanical Engineering

COURSE STRUCTURE & SYLLABUS

S.No.	Subject Code	Subject Name	L	Т	P/D	С
1	MA3102	Mathematics-IV	3	1		4
2	ME3101	Hydraulic Machines	3	1		4
3	ME3102	Metrology & Instrumentation	3	1		4
4	ME3103	Design of Machine Elements-I	3	1		4
5	BM3001	Managerial Economics and Financial Analysis (MEFA)	3	1		3
6	BM3101	Personality Development	2			1
7	ME3702	Metrology & Instrumentation Lab			3	2
8	ME3703	Machine Drawing Practice(MD Lab)			3	2
9	ME3701	Fluid Mechanics & hydraulic machines Lab			3	2
10	ME3901	Seminar-II				1
	1	Total	17	4	9	27

III Year – I Semester

CODE: MA3102

MATHEMATICS-IV

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits :4Hours/Week(3Theory + 1 Tutorial) : 3 Hours : 60 Marks : 40 Marks : 4

Objectives:

- > To introduce the student, the expansion of periodic functions, and their applications.
- To introduce the methods of forming and solving Partial differential equations, Also Z-Transforms
- > To introduce basic statistical methods like curve fitting, correlation and regression.

UNIT –I

Fourier series and Fourier transforms: Fourier series, Fourier series expansions of even and odd functions, convergence of Fourier series, Fourier half range series, Fourier transforms, inverse Fourier transforms, Fourier cosine & sine transforms.

UNIT –II

Partial differential equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients.

UNIT-III

Application of Fourier series to linear partial differential equations: Classification of linear second order partial differential equations, separation of variables method (Fourier method), Fourier series solution of one dimensional heat equation, one dimensional wave equation, Laplace's equation.

UNIT –IV

Z-Transforms: Introduction, basic theory of Z-transforms, Z-transforms of standard sequences, existence of Z-transform, linearity property, translation theorem, scaling property, initial and final value theorems, differentiation of Z-transform, convolution theorem, solution of difference equations using Z-transforms.

UNIT-V

Curve fitting by method of least squares, correlation and regression, types of correlations, scatter diagram, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, equal ranks, correlation factor, equations to the lines of regression.

Suggested Reading:

1. Advanced Engineering Mathematics - R.K.Jain & S.R.K. Iyengar 3rd Edition, Narosa Publications for I, II, III, IV units.

2. Higher Engineering Mathematics-H.K. Dass, Er.Rajnish verma for unit V.

- 3. Kreyszig E, Advanced Engineering Mathematics, 8 th Edition, John Wiley & Sons Ltd, 2006.
- 4. Gupta & Kapoor: Fundamentals of Mathematical statistics, Sultan chand

HYDRAULIC MACHINES

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits :4Hours/Week(3Theory + 1 Tutorial) : 3 Hours : 60 Marks : 40 Marks : 4

Objectives:

- The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow
- > To introduce the concepts of flow measurements and flow through pipes
- > To introduce the concepts of momentum principles
- > To impart the knowledge on pumps and turbines

Unit-I

Introduction: Classification of Hydraulic machinery. Energy transfer in hydraulic turbines. Positive displacement and Rotodynamic pumps and description of their working principles. Dynamic action of water: Impact of water jets on flat plates and curved surfaces – single and series, stationary and moving types. Forces on hinged plates and pipe bends. Impulse – momentum equation. Flow over radial and curved vanes.

Unit-II

Reciprocating pumps: Classification, working details, theory and terms used for single and double acting pumps. Effect of acceleration head and friction. Indicator diagrams. Effect of cavitation and limiting suction head on pump speed. Variation of pressure inside pump cylinder during suction and delivery strokes. Work done, power required and efficiency. Functions of air vessels. Work saved and rate of flow from air vessels. Losses and performance curves for reciprocating pumps. Industrial applications.

Unit-III

Centrifugal pumps: Working and constructional details of single stage centrifugal pump. Installation. Priming – significance and methods of priming. Basic classification of CF pumps. Types of impellers, casings and vane shapes used. Simple and multistage pumps and their applications. Series and parallel operation of CF pumps. Theory and terminology used CF pumps. Manometric head and its importance. Manometric efficiency and other efficiencies. Losses in CF pumps. Velocity diagrams. Effect of number of vanes and outlet angle of vane on head developed. Design of radial impellers and volute casing. Origin of cavitation. Limiting suction lift and NPSH. Principles of similarity: Unit quantities, specific speed, performance prediction from model testing. Performance and characteristic curves. Methods of balancing of end thrust in CF pump installations.

Unit-IV

Hydraulic Turbines: Classification of impulse and reaction turbines and their differences in working. Impulse turbines: Salient features and working details of Pelton wheel installation. Velocity diagrams. Calculation of number of buckets, bucket sizes and power developed. Overall efficiency, speed regulation methods. Reaction turbines: Constructional details and working of Francis and Kaplan turbines. Draft tube in reaction turbines. Theory, types and efficiency of draft tubes. Velocity diagrams. Blade angles and blade dimensions. Power developed and efficiencies, pressure head at inlet of the runner. Principles of similarity applied to hydraulic turbines. Unit quantities, specific speed and its significance for turbine selection. Performance prediction from model tests. Performance and characteristic curves for Pelton wheel, Francis and Kaplan turbines. Characteristic diagram. Automatic speed regulation in power plants. Losses in turbine operation. Cavitation effects in reaction turbines and remedial measures. Functions and types of surge tanks.

Unit-V

Hydraulic equipment and system: Working and simple problems on hydraulic ram, hydraulic accumulator and intensifier and hydraulic press. Working details of fluid coupling torque converter. Description of general hydraulic valves in use. Hydraulic power controls and fluidics: General description of servo-mechanism – Block diagram, types and applications, servo valves. Description of simple valve operated and pump controlled servo mechanisms. Introduction to fluidics. Terms used and Basic concepts of fluidic devices and attachment device. Description of working of amplifiers - Bistable, proportional, Turbulence and Vertex types.

Suggested Reading

1. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co., 1965.

2. Modi, P.N. & Seth, S.M., *A Text book of Fluid Mechanics and Hydraulic Machines*, Standard Book House, New Delhi, 2007.

3. N.S. Govind Rao, Fluid Flow, Tata Mc Graw Hill, 1983.

4. R.K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., 2004.

5. Subirkar, *Introduction to Fluidics*, Published at Oxford & IBM Publishing Co., Bombay & New Delhi, 1984.

CODE: ME3102 METROLOGY AND INSTRUMENTATION

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits :4Hours/Week(3Theory + 1 Tutorial) : 3 Hours : 60 Marks : 40 Marks : 4

Objectives:

- > To familiarize with Limits & fits, I.S.O. system and the instruments used to measure these limits.
- > To have knowledge of various precision linear and angular measuring instruments.
- > To learn the importance of form and how to measure form errors.
- > To understand the working principles of various instruments used for the measurement of strain, forces, pressure, temperature and vibrations.

Unit-I

Limits and Fits, I.S.O. system. Types of interchangeability. Slip gauges and end bars. Height gauges, Abbe's rule, Types of micrometers. Tomlinson gauges, sine bar, autocollimator, calibration of precision polygons and circular scales. Dial indicator, Sigma mechanical comparator. Free flow and back pressure type Pneumatic comparators. Contact & non-contact tooling, Applications of single and multijet gauge heads; computation and match gauging.

Unit-II

Optical projector-measurement by comparison, movement and translation, chart gauge types and microgauge bridge lines. Tool maker's microscope, Floating carriage diameter measuring machine and coordinate measuring machine. Measurement of straightness & flatness using autocollimator. Roundness measurement with intrinsic datum (V-block, Bench centers) and extrinsic datum (TALYROND).

Unit-III

Taylor's principles for plain limit gauges. Usage and limitations of Ring and Snap gauges. Indicating type limit gauges. Position and receiver gauges, principles of thread gauging. Gauge materials and steps in gauge manufacture. General geometrical tests for machine tools. Surface roughness characteristics and its measurement. Elements of instrumentation system. Static characteristics, Systematic and random errors. Dynamic response of first and second order instruments.

Unit-IV

Strain Measurement: Wire and foil type resistance strain gauges, Evaluation of principal strains with Rosette gauges. Desirable characteristics of gauge material, backing material and adhesive. Ballast and bridge circuits. Lead resistance compensation. Adjacent arm and self temperature compensating methods. Strain gauge calibration. Strain gauge circuits for measuring axial load, bending load and torque. Measurement of displacement with LVDT and Lasers interferometry.

Unit-V

Force Measurement: Proving ring, Strain gauge load cells, Piezo-electric load cell, Ballastic weighing, Pneumatic and hydraulic force meters.

Pressure Measurement: Thermocouple vaccum gauge, High and Low pressure measuring devices. Pirani gauge, Bourdon gauge and Bulk modulus gauge, calibration methods.

Vibration measurement, accelerometers, vibration exciters, calibration of vibrometers.

Temperature measurement: Laws of thermo electricity, types of materials and junctions used in thermocouples, lead and extension wires, ambient temperature compensation, protection tubes, series and parallel circuits. RTD. Total radiation and Optical Pyrometers.

Suggested Reading

1. R.K. Jain, *Engineering Metrology*, Khanna Publications, 1996.

2. I.C. Gupta, A text book of engineering metrology, Dhanpat Rai & Sons, 1984.

3. Bechwith, Marangoni, Lienhard, *Mechanical measurement*, LPE; Pearson Education Asia 2000.

4. D.S. Kumar, Mechanical Measurements, Metropolitan Book Co., New Delhi, 2001.

5. Rega Rajendra, Engineering Metrology

REFERENCES:

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.

2. Fundamentals of Dimensional Metrology, Connie Dotson, 4e, Thomson

3. Handbook of Tribology: Materials, Coating, and Surface Treatments, Bharat Bhushan and B.K.Gupta.

4. Surface Engineering with Lasers, Dehosson J.T.

5. Surface Engineering for corrosion and wear resistance, JR Davis, Woodhead Publishers.

CODE: ME3103 DESIGN OF MACHINE ELEMENTS-I

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits :4Hours/Week(3Theory + 1 Tutorial) : 3 Hours : 60 Marks : 40 Marks : 4

Objectives:

- To understand the basics of mechanics of materials and design of a machine for static and fatigue strength, rigidity and wear criterions, use of codes and standards.
- > To know the principles of ergonomic design.
- > To learn the principles to design shafts, keys, belt drives, joints and couplings.

Unit-I

Introduction, Materials used in machine design and their specifications to Indian standards. Important mechanical properties of materials used in design. Codes and standards used in design. Reliability, Principles of good Ergonomic Design, Manufacturing considerations. Preferred numbers. Value analysis.

Analysis of Stress and Strain : Definition of stress and strain, Types of loading, Direct normal stress, bending stress, Torisonal stress, crushing and bearing stresses, Biaxial stress and Triaxial stress.

Theories of elastic failure, Stress concentration factor, factor of safety, Design of components for static loads, Introduction to thermal stresses.

Unit-II

Design for Fatigue and Impact loads; Importance of fatigue in design, Fluctuating stresses, fatigue strength and endurance limit. Factors affecting fatigue strength. S-N Diagram, Soderberg and Modified Goodman's diagrams for fatigue design. Cumulative fatigue, Miner's rule, Design of components for fatigue. Design of components for impact loading.

Unit-III

Design of keys, shafts – solid hollow stepped shafts and splined shafts under torsion and bending loads. Design of belt drive systems, selection of belts and design of pulleys.

Unit-IV

Design of cotter and knuckle joints, riveted and welded joints under direct and eccentric loading. Design of couplings – Muff and Split Couplings, Flange, Flexible and Marine type of couplings.

Unit-V

Design of bolts and nuts, locking devices, bolt of uniform strength, design of gasket joints, design of power screws and screw jack. Thick and thin cylinders.

Suggested Reading

1. V.B. Bhandari, *Machine Design*, Tata Mc Graw Hill Publication, 1991.

2. J.E. Shigley, C.R. Mischne, *Mechanical Engineering Design*, Tata Mc Graw Hill Publications, 2003.

3. Robert C. Juvinall, Fundamentals of Machine Component Design, John Wiley & Sons, 2005

4. Robert L. Norton, Machine Design: An Integrated Approach, 2/e Pearson Education, 2000

5. M.F. Spotts, Design of Machine Elements, Prentice Hall of India, 1964.

REFERENCES:

- 1. Machine design- J.E.Shigley
- 2. Machine design- R S Khurmi and J K Gupta
- 3. Design Of Machine Elements M.F.Spotts-PHI
- 4. Machine Design Kannaiah/ Scietech.

CODE: BM3001

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits :4Hours/Week(3Theory + 1 Tutorial) : 3 Hours : 60 Marks : 40 Marks : 3

Course Objective: To make the students understand the concepts and principles of Business Economics at micro level and basic principles of Financial Accounting and Analysis, which facilitate them in making better planning and decisions.

UNIT I

INTRODUCTION TO MANAGERIAL ECONOMICS: Definition, Nature and Scope of Business Economics–Demand Analysis: Demand Determinants, Law of Demand and its exceptions, Elasticity of Demand and Demand Forecasting.

UNIT II

THEORY OF PRODUCTION AND COST ANALYSIS: Production Function – Isoquants and Isocosts, Internal and External Economies of Scale, Laws of Returns. Cost Analysis: Cost concepts, different types of costs, cost control and cost efficiency, Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems).

UNIT III

INTRODUCTION TO MARKETS: Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Pricing strategies, transfer pricing and performance measurement, Price-Output Determination in case of Perfect Competition and Monopoly

UNIT IV

FUNDAMENTALS OF FINANCIAL ACCOUNTING: Concepts and conventions, principles of Double-Entry, Book Keeping, Journal, Ledger, Trial Balance, Final Accounts - Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments.

UNIT V

CAPITAL BUDGETING TECHNIQUES: Nature and scope of Capital Budgeting, Methods of Capital Budgeting: Traditional methods and Discounting Cash Flow methods.

RATIO ANALYSIS: Introduction to Ratio analysis – Leverage ratios – Liquidity ratios – Turnover ratios – Profitability ratios, Du-pont chart. (Simple problems)

Books Recommended:

• Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.

References:

- Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
- H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
- Suma Damodaran, Managerial Economics, Oxford University Press. Lipsey & Chrystel, Economics, Oxford University Press.

BM3101

PERSONALITY DEVELOPMENT

Externals: 60Marks Internals: 40Marks L-T-P-C 2-0-0-1

Guidelines: Learning approach is based on Real time case studies with class room activities

Course Objectives:

- 1. To develop interpersonal skills and be an effective goal oriented team player.
- 2. To develop professionals with idealistic, practical and moral values.
- 3. To develop communication and problem solving skills.
- 4. To re-engineer attitude and understand its influence on behavior.
- 5. To enhance holistic development of students and improve their employability skills.

UNIT I-SELF ANALYSIS (6 hours)

SWOT Analysis, Who am I, Personality Traits, Importance of Self Confidence, Self Esteem.

UNIT II-GOALS SETTINGS (6 hours)

Short term , Long term goal settings, SMART concept Diversifying Risk and Optimizing Opportunities

UNIT III- TEAM DYNAMICS WITH INTERPERSONAL SKILLS (8 hours)

Team Dynamics, Team Work, Interpersonal Skills

Behavioral Skills GD, PI, Body Language Public Speaking, Verbal, Non Verbal Communications

UNIT IV-CREATIVITY and RATIONALITY (8 hours)

Out of Box thinking, Idea Generation with creativity Brain Storming, Effective group meetings, Rationalization of ideas and way to effective implementation.

Class room and team activities coupled with group tasks depending upon time availability

FLUID MECHANICS AND HYDRAULIC MACHINES LAB

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits : 3 Hours/Week (3 Practical) : 3 Hours : 60 Marks : 40 Marks : 2

Course Educational Objectives:

• To familiarize with conservation laws, dimensional analysis to fluid flow problems and hydraulic machines.

Course Outcomes:

Students undergoing this course are able to

- Measurement of various fluid properties and relate to practical applications.
- Design and conduct an experiment, as well as analyze and interpret data

LIST OF EXPERIMENTS

- 1. Verification of Bernoulli's theorem.
- 2. Coefficient of discharge of given Orifice meter / Venturi meter.
- 3. Coefficient of discharge of given Pitot tube.
- 4. Friction Factor of fluid flow by Major loss / Minor loss equipments.
- 5. Rate of flow using Rota meter.
- 6. Characteristic curves of Centrifugal Pump / Reciprocating Pump.
- 7. Characteristic curves of Gear Pump /Jet Pump.
- 8. Characteristic curves of Submersible Pump.
- 9. Characteristic curves of Pelton Wheel Turbine.
- 10. Characteristics curves of Francis Turbine.
- 11. Characteristic curves of Kaplan Turbine.

LIST OF EQUIPMENTS:

For a student's strength of 40

S. No.	Equipment Name	Nos. Required
1	Bernoulli's Theorem Apparatus	1
2	Orificemeter	1
3	Venturimeter	1
4	Pitot tube	1
5	Major Loss for friction factor	1
6	Minor Loss for friction factor	1
7	Rotometer	1
8	Centrifugal Pump	1
9	Reciprocating Pump	1
10	Submersible Pump	1
11	Submersible Pump	1
12	Jet Pump	1
13	Pelton Wheel Turbine	1
14	Francis Turbine	1
15	Kaplan Turbine	1
16	Stop Watch	8
17	Steel Ruler	2

Note: one teaching staff and one lab assistants required for a student's strength of 40

BEYOND THE SYLLABUS:

- Study about Cut section of turbines
- Study about Cut section of pumps
- Experiment in Impulse turbine

METROLOGY AND INSTRUMENTATION LAB

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits : 3 Hours/Week (3 Practical) : 3 Hours : 60 Marks

- : 40 Marks
- : 2

Course Educational Objectives:

• To understand by conducting experiments, (i) the linear and angular measurements and calibration (ii) the measurements of displacement, force, torque, temperature and vibration (iii) checking the limits of dimensional tolerance.

Course Outcomes:

Students undergoing this course are able to

- Design of measurement experiments to measure various parameters and correlate with theoretical knowledge.
- Ability to report the results of a laboratory experiment in written, oral & graphical manner.

LIST OF EXPERIMENTS

- 1. Calibration of linear measuring instruments
- 2. Calibration of angle measuring instruments
- 3. Measurement of Taper Angle
- 4. Measurement of straightness and flatness
- 5. Measurement of thread parameters
- 6. Measurements of Gear Tooth Dimensions
- 7. Checking the limits of dimensional tolerances using comparators
- 8. Measurement of Temperature
- 9. Measurement of Displacement
- 10. Measurement of Force
- 11. Measurement of Torque
- 12. Measurement of Vibration

LIST OF EQUIPMENTS

For a student's strength of 40

S. No.	Equipment Name	Nos. Required
1	Vernier caliper	1

2	Micrometer	1
3	Gear tooth Vernier	1
4	Sine bar	1
5	Profile projector	1
6	Slip gauge	1
7	Dial gauge	1
8	Electrical comparator	1
9	Floating carriage micrometer	1
10	Vibrating system	1
11	LVDT	1
12	Microscope	1
13	Surface plate	1
14	Autocollimator	1
15	Gear testing machine	1
16	Thermocouple	1
17	Thermometer	1

BEYOND THE SYLLABUS:

- 1.Tool Maker's Microscope
- 2. Co.ordinate Measuring Machine.
- 3. Machine Vision System
- 4.Laser Measuring Instruments

CODE: ME3703 MACHINE DRAWING PRACTISE

Instruction Duration of External Exam Scheme of External Exam Scheme of Internal Exam Credits : 3 Hours/Week (3 Practical) : 3 Hours

: 60 Marks

: 40 Marks

:2

Objectives:

- > To understand format of drawing sheet, angle of projections and practice of simple machine elements
- > To practice free hand sketching of machine elements
- To understand assembly drawings of typical machine parts such as Connecting rod, Eccentric, Cross head, Machine vice, Screw jack, Non-return valves, Safety valves, Bearings, Tail stock etc.

I. Machine Drawing Conventions:

Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.

b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.

c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

d) Title boxes, their size, location and details - common abbreviations & their liberal usage

e) Types of Drawings – working drawings for machine parts.

II. Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.

b) Keys, cottered joints and knuckle joint.

c) Rivetted joints for plates

d) Shaft coupling, spigot and socket pipe joint.

e) Journal, pivot and collar and foot step bearings.

III. Assembly Drawings:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) Engine parts – stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, piston assembly.

b) Other machine parts - Screws jacks, Machine Vices Plummer block, Tailstock.

c) Valves : Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE : First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS :

Machine Drawing – Dhawan, S.Chand Publications Machine Drawing - K.L.Narayana, P.Kannaiah & K. Venkata Reddy, New Age Publishers

REFERENCES :

Machine Drawing – P.S.Gill. Machine Drawing – Luzzader Machine Drawing – Rajput Textbook of Machine Drawing –K.C.John, 2009, PHI learning

SEMINAR-II

Scheme of Internal Exam	: 25 Marks
Credits	:1

Objectives:

Objective of the project seminar is to actively involve the students in preparation of the final year project with regard to following components:

- Problem definition and specification
- > Literature survey, familiarity with research journals
- > Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of graphs, bar (activity) charts and analyzing the results.
- Presentation oral and written.

The evaluation is purely internal and will be conducted as follows:

Preliminary Report on progress of the work and viva	05 marks
Final report	05 marks
Presentation and Defense before a departmental committee	
Consisting of Head, a senior faculty and supervisor	15 marks
