Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): FIFTH SEMESTER

BEME501T: INDUSTRIAL ECONOMICS AND ENTREPRENEURSHIP DEVELOPMENT (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week	Duration of Paper: 03 Hours
Tutorial: 1 Hour/Week	University Assessment: 80 Marks
	College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to create awareness about economics terminology and business organization, to understand relationship between business, market and society, to create awareness about entrepreneurship as a career avenue; financial agencies and government support systems for entrepreneurship. This course shall stimulate the potential to develop entrepreneurial orientation through innovation, creativity & students will understand the concept of innovation, invention, creativity and discovery in engineering context and shall also get awareness about IPR and Patents.

UNIT – I **[8 Hrs.]**

Industrial Economics : Economics, classification of economics, Basics concepts, Law of demand, Demand analysis, Types of demand, Determinants of demand, Methods of demand forecasting, Supply, Law of diminishing marginal utility, Elasticity of demand, Types of elasticity of demand.

UNIT – II **[8 Hrs.]**

Factors of production, Production function, Firm and Industry, Law of return, Cost concepts, Fixed variable, Average, Marginal and Total cost, Break even analysis Depreciation and methods for depreciation.

UNIT – III **[8 Hrs.]**

Inflation, effect of inflation, Monetary and fiscal measures to control inflation, deflation, stagflation direct and indirect taxes. Market and market structures, Perfect competition, Monopoly, Monopolistic competition, Oligopoly, Price determination in these Situations. Concept & overview of share market, Effect of share market on economy, Share market terminologies.

UNIT – IV **[8 Hrs.]**

Innovation & Creativity: Concept of creativity, innovation, invention, discovery. Methods for development of creativity, convergent & divergent thinking etc. Introduction to Intellectual Property Rights (IPR), Patent and laws related to patents.

UNIT – V **[8 Hrs.]**

Concept of entrepreneurship, its relations in economic developments, Eventuation of concept of entrepreneur, characteristics of an Entrepreneur, Types of entrepreneurs, Qualities of entrepreneur, Factors affecting growth of entrepreneurship. Theory of achievement, motivation, Medelland's. experiment, Women entrepreneurship, Role of SSI, it's advantages & limitations, policies governing small scale industries, Procedure to set up small scale industrial unit, Advantages and limitations of SSI.

UNIT – VI **[8 Hrs.]**

Preparation of project report: Factors governing project selection, Market survey, Preparation of project report. Financial, technical & market analysis of project. Entrepreneurial support systems, Role of consultancy organization like, District Industrial Centre, State Industrial Development Corporation, Financial institution, Latest SSI schemes of DIC (to be confirmed from DIC from time to time)

Note: Group of students (Min 05 & Max 09) are expected to prepare a project report for business / industry on the knowledge acquired.

TEXT BOOKS:

1. Modern Economics, H. L. Ahuja, S.Chand Publishers
2. Modern Economic Theory, K. K. Dewett., S. Chand Publishers
3. Engineering Economics, D. N. Dwivedi, A. Dwivedi, Vikas Publishing House
4. Entrepreneurship Development, S. S. Khanka, S. Chand Publishers
5. Creativity Innovation & Entrepreneurship, Zechariah James Blanchard, Needle Rat Business Publishers.

BEME502T: DESIGN OF MACHINE ELEMENTS (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to understand the basic machine element design. It includes the procedure of design (w.r.t. basic failures) under various loading conditions. Students shall understand design of various mechanical joints, machine components such as shaft, keys, brakes clutches, power screws etc. Apart from this, students shall learn spring design & pressure vessel design. At the end of this course, students will get familiar with design of these mechanical components under various loading conditions.

UNIT – I **[12 Hrs.]**

Introduction to Mechanical Engineering Design, Design methods, Aesthetic and Ergonomics Consideration in design , Material properties and their uses in design , Basic 'principles of Machine Design, Modes of failures, I. S. codes, Preferred Series and numbers. Design of Knuckle joint, Socket & Spigot type cotter joint. Design of riveted joint.

UNIT – II **[12 Hrs.]**

Design of bolted and welded joints under axial and eccentric loading conditions. Design of Brackets & Levers.

Design of Cylinder & Pressure Vessels: Types of pressure vessel, stresses induced in pressure vessel, Lame's, Clavarino's and Bernie's equations. Design of cylindrical & spherical pressure vessels. Design of nut, bolt, gasket & covers for pressure vessel.

UNIT – III **[12 Hrs.]**

Design of shaft for power transmission, static and fatigue criteria for shaft design, ASME codes for shaft design, Design of keys.

Design of Springs: Spring material, Helical compression & tension springs under static and variable loads, Leaf spring, Laminated Springs.

UNIT – IV **[12 Hrs.]**

Design of power screw: Thread forms, multiple threaded screws, terminology of power screw, design of screw jack.

Design of clutches and brakes: Single and multiple plate clutch, constant wear and constant pressure theory for plate clutches, Internal and external shoe brakes.

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TEXT BOOKS:

1. Design of Machine Elements, B.D.Shiwalkar, Central Techno Publications
2. Design of Machine Elements, V. B. Bhandari, Tata McGraw Hill Pub.
3. Mechanical Engineering Design, J. E. Shigley, McGraw Hill.
4. Design Data Book, B.D.Shiwalkar, Central Techno Publications.
5. Design Data Book, PSG.
6. Design Data Handbook Book, K. Mahadevan, CBS Publishers.
7. Mechanical Design of Machine Elements & Machines, J.A.Collins, Wiley India
8. Machine Components Design, Robert C., Juvinall & Kurt M. Marshek, Wiley India
9. Machine Design, U.C. Jindal, Pearson Publications
10. Machine Design : An Integrated Approach, Robert L Norton, Pearson Publications
11. Machine Design Fundamental and Applications, P.C. Gope, PHI Learning.
12. Design of Machine Elements, Sharma C.S. & Purohit K, PHI Learning.

REFERENCE BOOKS:

1. Design of Machine Elements, Spotts M. F. and Shoup T. E., Pearson Publications.
2. Machine Design, Black P. H. and O. Eugene Adams, McGraw Hill Book Co Inc.

BEME503T: ADVANCED PRODUCTION PROCESSES (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This subject is designed to make conversant with non conventional machining processes, advanced Joining Processes, Die Cutting Operations, Jig and Fixtures, Super -finishing operations & Machining centre. Upon completion of this course, student shall understand the unconventional machining processes and will be able to select and apply suitable processes for engineering products.

UNIT – I **[8 Hrs.]**

Non- conventional machining Processes: Introduction & classification, Electrochemical machining, Electrical Discharge machining, Ultrasonic machining, Laser beam machining, Electron beam machining, Water jet machining, Abrasive jet machining. Advantages, disadvantages and applications of above processes.

UNIT – II **[8 Hrs.]**

Advanced joining Processes : Introduction and classification of welding techniques, Advanced welding processes such as TIG, MIG welding, Plasma arc welding, Plasma welding, Oxyacetylene welding , Atomic hydrogen welding , Laser beam welding , Electron beam welding , Electro slag welding.

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UNIT – III **[8 Hrs.]**

Advanced machining Processes: Introduction, Classification, Capstan and turret lathe, Tool layout for capstan and turret lathe, Machining center.
Introduction to micromachining, nanofabrication, high energy rate forming.

UNIT – IV **[8 Hrs.]**

Die cutting operations: Introduction, Sheet metal cutting, Sheet metal forming, Sheet metal drawing, defects in drawn parts, Spinning, Equipments for sheet metal working, Die and punch.

UNIT – V **[8 Hrs.]**

Jigs and fixtures: Introduction, principles of jig and fixture, Principle of location, jig bushes, drilling jigs, type of clamps, classification of fixtures.

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UNIT – VI **[8 Hrs.]**

Super finishing processes: Introduction, Principle of super finishing process, Lapping, Honing, Buffing & Electroplating.
Principle of operation, advantages, disadvantages and applications of above processes. Application of LASER in surface modification.

Note: All the teachers are advised to show the relevant videos for the above processes.

TEXT BOOKS:

1. Production Technology, P.C. Sharma, S.Chand Publication.
2. Manufacturing Engineering and Technology, Serope KalpakJan, Pearsons.
3. Manufacturing Technology, D.K. Singh, Pearsons.
4. Unconventional Manufacturing Processes, M.K. Singh, New Age Publications.
5. Non-Conventional Manufacturing Processes, H.S. Shan, Tata Mc-Graw Hill.

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BEME504T: HEAT TRANSFER (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to learn the various modes of heat transfer and laws associated with it. During this course, students can distinguish between steady state and unsteady state heat transfer; will be able to apply their knowledge of Dimensional Analysis to forced and free convection. Students will also be able to analyse radiation with and without radiation shield. Apart from this, students will also be able to analyse & design heat exchangers.

UNIT – I **[8 Hrs.]**

Introduction to basic modes of heat transfer, conduction, convection & radiation. Laws of heat transfer & conservation of energy requirement. General heat conduction equation in cartesian, cylindrical and spherical coordinates. One dimensional steady state heat conduction equation for the plane wall, cylinder and sphere, overall heat transfer coefficient. Thermal resistance of composite structure, contact resistance, variable thermal conductivity, critical thickness of insulation.

UNIT – II **[8 Hrs.]**

Conduction with internal heat generation for plane wall, cylinder and sphere. Extended surface, types of fins. Fins of uniform cross section area, temperature distribution and heat transfer rate, fin efficiency & effectiveness. Error in temperature measurement. Unsteady state heat transfer, lumped heat capacity analysis, Heisler's charts. Biot Number, Fourier's Number & its significance.

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UNIT – III **[8 Hrs.]**

Forced convection, physical significance of non-dimensional parameter. Flow of high, moderate & low Prandtl number, fluid flow over a flat plate. Concept of hydrodynamics & thermal boundary layer thickness, local and average heat transfer coefficient. Empirical co-relations for external, internal flows, laminar & turbulent flow through conduits. Dimensional analysis applied to forced convection.

UNIT – IV **[8 Hrs.]**

Free or natural convection. Grashoff's number, Rayleigh number, flow over horizontal and vertical plate, Empirical Co-relations for cylinders and spheres, heat transfer with phase change, pool boiling curve & regimes of pool boiling, Film & Drop wise condensation, laminar film condensation on vertical surface, on horizontal tubes, effect of super heated & non-condensable gases on condensation heat transfer, Dimensional analysis applied to free or Natural convection.

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UNIT – V **[8 Hrs.]**

Radiation, spectrum of radiation, black body radiation, radiation intensity, laws of radiation- Kirchoffs, Plancks, Weins displacement law, Stefan Boltzmann & Lamberts Co-sine law. Emissivity, Absorbtivity, Transmissivity, Reflectivity, Radiosity, Emissive power, Irradiation. Radiation network, radiation exchange between parallel plate cylinder & sphere, shape factor & its laws, radiation between parallel plates, cylinder & spheres. Radiation shields.

UNIT – VI **[8 Hrs.]**

Heat exchanger : Classification, overall heat transfer coefficient, fouling factor, LMTD & effectiveness, NTU method of heat exchanger analysis for parallel, counter flow & cross flow arrangement, design aspect of heat exchangers, Introduction to compact heat exchanger, Heat Pipe, Introduction to mass transfer.

TEXT BOOKS:

1. Heat Transfer, J.P. Holman, McGraw Hill Book Company, New York.
2. Fundamentals of Heat and Mass Transfer, K. N. Seetharam & T.R. Seetharam, Willey.
3. A Text Book of Heat Transfer, S.P. Sukhatme, University Press.

REFERENCE BOOKS:

1. Fundamentals of Heat and Mass Transfer, Venkanna B.K., PHI Publication.
2. Principles of Heat Transfer, Frank Kreith, Harper and Row Publishers, New York.
3. Heat Transfer - A Practical Approach, Yunus A. Cengel, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Heat & Mass Transfer, M.N. Ozisik, Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Heat & Mass Transfer, R.K. Rajput, Laxmi Publication.

DATA BOOK: Heat & Mass Transfer, Domkundwar, Dhanapat Rai & Sons Publication.

BEME504P: HEAT TRANSFER (Practical)

CREDITS: 01

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	University Assessment: 25 Marks
	College Assessment:25 Marks

LIST OF PRACTICALS:

Minimum Eight out of the following shall be performed (Out of which Six must be experimental):

1. To determine the thermal conductivity of composite wall.
2. Determination of thermal conductivity of an insulating powder.
3. Determination of thermal conductivity of metal bar.
4. Determination of Stefan Boltzmann constant.
5. Determination of temperature distribution & heat transfer rate from fin under forced convection.
6. Determination of heat transfer coefficient in natural convection for vertical tube.
7. Determination of condensation heat transfer coefficient in film wise & drop wise condensation.
8. Determination of emmissivity of non black body.
9. Study of various types of heat exchangers.
10. Computerized analysis of various parameters of heat exchanger using shell and tube heat exchanger.
11. Study of heat pipe.

BEME505T: MECHANICAL MEASUREMENT & METROLOGY (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to study various measurement systems and their significance along with the characteristics and order of the instruments. At the end of this course, students will be able to understand various instruments for the measurement of different parameters, tolerances, advanced concepts involved in measuring technology (Measurements) & use of precision measuring instruments. Students will appreciate the importance of accuracy and its effects on results and its uncertainty.

UNIT – I **[8 Hrs.]**

Purpose, structure and elements of measuring system. Static characteristics of measurement system, elements including systematic, statistical characteristics, generalized model of system elements and calibration. Error measurement, error probability density function, error reduction. Introduction to dynamic characteristics of measurement system. Introduction to noise in measurement system.

UNIT – II **[8 Hrs.]**

Classification, Principle, Sensing elements, Signal conditioning elements, Construction, Range and working of instruments for measurement of Linear and Angular Displacement, Speed, Load, Strain, Force, Torque and Power. (Analytical treatment not included)

UNIT – III **[8 Hrs.]**

Classification, Principle, Sensing elements, Signal conditioning elements, Construction, Range and working of instruments for measurement of Pressure, Vacuum, Sound, Light and Temperature. (Analytical treatment not included)

UNIT – IV **[8 Hrs.]**

Standards of Measurement, Line, End and Wavelength standard. Working standards, Requirement of interchangeability, Allowance and Tolerance, Selective assembly. Measurement of Straightness and Flatness. Instruments for Linear and Angular Measurement. (Vernier, Angle gauge, Sine bar, Level indicator, Clinometers and Taper gauge)

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UNIT – V **[8 Hrs.]**

Limits and Fits, Tolerance analysis of Limits and Fits, Types of limit gauges, Types of fit, Shaft and Hole basis system, Design of Limit gauge and Process planning sheet (Numerical treatment is expected).

UNIT – VI **[8 Hrs.]**

Comparators: Mechanical, Optical, Electrical, Electronic, Pneumatic.

Study and use of Optical profile projectors, Tool maker's microscope and Autocollimator. Measurement of Screw thread and Gear tooth.

LIST OF TUTORIALS:

1) Study of Linear and Angular measurement instrument.
2) Study of various types of Comparators.
3) Preparation of Process Planning sheet.

TEXT BOOKS:

1. Mechanical Measurement and Control, D.S. Kumar, Metropolitan Book Co.
2. Instrumentation Measurement and Analysis, B.C. Nakra, K.K. Choudhary, TMH
3. Measurement Systems, Ernest O. Doebelin, Dhanesh N. Manik, TMH
4. Mechanical Measurement, Thomas G. Beckwith, Pearson
5. Metrology and Measurement, Anand K. Bewoor, Vinay A. Kulkarni, TMH
6. Metrology, R. K. Jain, Khanna Publishers.
7. A Textbook of Engineering Metrology, I. C. Gupta, Dhanpat Rai & Sons Publication.

REFERENCE BOOKS:

1. Principles of Measurement Systems, John P. Bentley, Pearson

BEME505P: MECHANICAL MEASUREMENT & METROLOGY (Practical)

CREDITS: 01

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	University Assessment: 25 Marks
	College Assessment:25 Marks

LIST OF PRACTICALS:

Minimum Eight out of the following shall be performed:

1. Static characteristic of at least one Instrument.
2. Static calibration of at least one Instrument.

3, 4 & 5. – Measurement of parameters by minimum three different types of Instruments.

6. Measurement of Linear, Angular dimensions (Using Vernier, Sine bar, Clinometers)
7. Measurement of Flatness & Straightness.
8. Study and Measurement of Parameters using Toolmaker's microscope.
9. Study and Measurement of Parameters using Optical profile projector.
10. Use of Optical flat.
11. Design of Limit gauge.

BEME506P: COMPUTER APPLICATIONS – I (Practical)

CREDITS: 04

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	University Assessment: 50 Marks
Tutorial: 2 Hour/Week	College Assessment:50 Marks

Course Objectives and Expected Outcomes: This course is designed to acquaint the students to solve engineering problems using computers with knowledge of C/C++ programming. Students will be able to write the programs for Numerical Methods & for problem solving in the area of Mechanical Engineering. Students will also understand the concept of OOPs and will get introduced with mathematical softwares.

Review – C/C++ Programming basics, algorithm, types of algorithms, data type, variables, control structures, arrays, vectors, pointers, functions, file handling etc., Basic of OOPS, and Object modeling.

Exposure to Software/s like MATLAB/ MATHCAD/ SCILAB / MATHEMATICA or any other relevant commercial software/s or freeware/s.

LIST OF PRACTICALS:

Minimum eight practicals in following areas shall be performed.

1. Development of application programs in C / C++ exploring use of functions, vectors, arrays etc.
2. Development of programs in C / C++ for any Numerical methods like Newton Raphson, Gauss-Elimination, Gauss-Jordan, Crout's method and Gauss-Seidel Method.
3. Development of programs in C / C+ + for any Numerical methods like Taylor's series method, Runge Kutta method, Euler's modified method, Milne's predictor corrector method, Iterative methods for eigen value & eigen vector determination.
4. Development of programs in C / C++ to solve the problem in the following areas of Mechanical Engineering like, Mechanics, Kinematics of Machines, Engineering Thermodynamics, Hydraulic Machines, Mechanics of Material, Design of Machine elements, Heat Transfer etc.
5. Application of Mathematical Software/s for solution of problems in the areas of Mechanical Engineering.

Note:

During University practical examination of 50 marks, students are expected to prepare & execute computer program/s in C/C++ and/or problem solving using mathematical softwares

of total 30 marks in two hours duration. Viva-Voce of 20 marks shall be conducted during University practical examination.

TEXT BOOKS:

1. An Introduction to Data Structures with Applications, Trembly J. P. And Sorenson P. G., Tata McGraw Hill Pub. Co. Ltd.
2. Fundamentals of Computer Algorithms, Horowitz E. And Sahani S., Galgotia Publications Ltd.
3. Programming in C, Gotterfield B., Schaums Outline Series.
4. Mastering C, R. Venu Gopal Prasad, Tata McGraw Hill Pub. Co. Ltd.

REFERENCE BOOKS: User/Command/Tutorial Manuals of relevant Softwares.

BEME507P: INDUSTRIAL VISIT

CREDITS: Nil (Audit Course)

Teaching Scheme
Practical: 02 Hour/Week

Course Objectives and Expected Outcomes: This subject aims at giving practical exposure to students and to provide opportunities for acquiring knowledge regarding manufacturing and service industries/organizations and to acquaint them with industrial culture. Upon completion of this course, students will be able to describe the usage of different technologies/tools/concepts related to Design process, operation of various machines, mechanical drives, manufacturing processes, machining processes, various process equipments, production techniques, quality control, maintenance practices, automation in industries, management etc.

Students shall visit different industries (at least two). Students shall be preferably divided into small groups to tour around the industry.

After each visit, each batch of students is required to submit a written report and shall give a brief oral presentation.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering and Technology

B.E. (MECHANICAL ENGINEERING): SIXTH SEMESTER

BEME601T: ENERGY CONVERSION- I (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to expose the students to the practical applications of thermodynamics. At the end of this course students will gain the knowledge of various components of the thermal power plant like boiler, nozzles, turbines and condensers and will be able to assess the performance of these components.

UNIT – I **[8 Hrs.]**

Introduction to layout of thermal power plant, principle of steam generation, fuel for steam generators, necessity of water treatment, classification of steam generators, fire tube and water tube boilers, high pressure boilers, boiler mountings and accessories.

UNIT – II **[8 Hrs.]**

Draught and its classification, calculations for chimney height, chimney diameter & efficiency. Condition for maximum discharge. Performance of steam generators: Evaporation capacity, equivalent evaporation, boiler efficiency.

UNIT – III **[8 Hrs.]**

Fluidized bed boiler: Bubbling fluidized bed boilers, circulating fluidized bed boilers (Elementary treatment expected), coal handling, ash handling.

Cogeneration: Introduction to cogeneration, need, working principle and applications. Topping cycle and bottoming cycle.

UNIT – IV **[8 Hrs.]**

Steam nozzles: Adiabatic expansion in nozzles, maximum discharge, critical pressure ratio and effects of friction, calculation of throat and exit areas, supersaturated flow, Wilson Line.

Steam turbines: Working principle of steam turbines, classification of steam turbines, comparison of impulse and reaction turbines, compounding of steam turbines, governing of turbines.

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UNIT – V **[8 Hrs.]**

Energy losses in steam turbines, flow of steam through turbine blades, reheat factors, velocity diagrams, graphical and analytical methods, work done, thrust and power, dimensions and proportioning of the blades, steam turbine efficiencies, condition for maximum efficiencies, reheat and regenerative cycles.

UNIT – VI **[8 Hrs.]**

Steam condensers: Types of condensers, classification of condensers, quality and quantity of cooling water required, calculations for surface condenser, Dalton's law of partial pressure, sources of air leakages and air removal, air ejectors.
Cooling towers: wet cooling towers, dry cooling towers, cooling ponds.

LIST OF TUTORIALS:

1) Three problems on draught.
2) Two problems on performance of boiler.
3) Two problems on heat balance sheet of boiler.
4) Two problems on nozzle.
5) One problem on metastable flow.
6) Two problems on impulse turbine.
7) Two problems on reaction turbine.
8) One problem on reheat cycles.
9) One problem on regenerative cycle.
10) Two problems on condenser.

TEXT BOOKS:

1. Thermal Engineering, P.L. Ballaney, Khanna Publications.
2. A Course in Power Plant Engineering, Arora & V.M. Domkundwar, Dhanpat Rai & Sons
3. Thermal Engineering, R. K. Rajput, Laxmi publications.
4. Thermal Engineering, M.M. Rathode, TMH publication.
5. A Course in Thermal Engineering, Anand Domkundwar, C.P. Kothandaraman, S. Domkundwar, Dhanpat Rai & Sons.

REFERENCE BOOKS:

1. Thermal Engineering, Mathur & Mehtra, Jain Brothers Publications, New Delhi.
2. Heat Engineering, V.P. Vasandani & D.S. Kumar, Metropolian Book Publishers.
3. Power Plant Engineering, A.K. Raja, Shrivastava and Dwivedi, New age International Publishers.
4. Fluidized Bed Combustion, S. Oka and E. Anthony, Marcel Dekker Inc.
5. Power Plant Engineering, M. M. EI- Wakil, McGraw Hill International.

BEME602T: CONTROL SYSTEMS ENGINEERING (Theory)

CREDITS: 04

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1 Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is formulated to familiarize the students with concepts related to the operation, analysis and stabilization of control systems. The main objective of this course is to make understanding of various control systems and its stability analysis using analytical and graphical techniques, to understand the concepts of Time Domain and Frequency Domain analysis of control system, Mathematical modeling and Transfer function of engineering systems. At the end of this course, student will be able to understand various control systems & their stability analysis.

UNIT – I **[8 Hrs.]**

Control System controls: Study of Control System components such as hydraulic actuators, Servomechanism D.C. and A.C. motor, liquid level control, Automobile Power Steering Control, Speed Control, Position control of Robotic Manipulator etc. Study and Analysis of performance characteristics, the concept of various types of system like machine tools, Prime movers, system generators, etc.

Modeling of Mechanical System: Basic Elements of Control System – Open loop and Closed loop systems – Differential equation – Laplace Transform –Transfer function, Modeling of physical system like Translational, rotational mechanical systems, Electric systems, Electronic system and Electro-mechanical system. Concept of transfer function & its determination for physical systems.

UNIT – II **[8 Hrs.]**

Transfer Function system Representation through Block Diagram and Signal Flow Graph: Block Diagram representation, Reduction Techniques for single and multiple input/output, Conversion of Block Diagram into Signal Flow Graph, Conversion of algebraic equation into Block Diagram and Signal Flow Graph. Transfer function through Block Diagram Simplification using Masons Gain Formula.

UNIT – III **[8 Hrs.]**

System Response & Time Domain Response Analysis: First and second order systems response to impulse, ramp and sinusoidal inputs, properties of unit step response of second order system, systems with velocity lag, Steady state errors and Error constants.

Signals: Step, Ramp, Impulse, Parabolic and Periodic signals with their mathematical representation and characteristics.

Mode of Controls: Basic control actions and Industrial controllers, Introduction to P, PI and PID controllers their characteristics, representation and applications. Classification of industrial automatic controllers, control actions, proportional controllers, obtaining derivative and integral control action, effects of integral and derivative control action on system performance.

Controller Mechanisms: Pneumatic, hydraulic and electric controllers, general principles for generating various control actions.

UNIT – IV **[8 Hrs.]**

Control system analysis: Concept and types of stability, Routh-Hurwitz Criterion and its application for determination of stability, limitations.

Root locus plot: Simple transfer functions transient response from root locus. Concept of stability, necessary condition for stability, Root locus concept, construction of Root loci.

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UNIT – V **[8 Hrs.]**

Frequency Domain analysis - Correlation between time and frequency responses of a second order System.

Bode & Polar plot: Determination of Gain Margin, Phase Margin and their Stability from Bode and Polar plots. Inverse Bode Plot, Transportation lag, System Identification from Bode plot.

UNIT – VI **[8 Hrs.]**

State space representation of Continuous Time systems: State equations, Transfer function from State Variable Representation – Solutions of the state equations, Concepts of Controllability and Observability, State space representation for Discrete time systems.

Stability criterion: Introduction to control system design lag lead compensation, Feed Back Compensation and Pole -Zero placement.

LIST OF TUTORIALS:

1) Mathematical Modeling of Mechanical and Electrical System.
2) Numerical examples of Block Diagram Reduction Technique and Signal Flow Graph.
3) Numerical of Time response analysis.
4) Numerical of Frequency Domain analysis.
5) Numerical of Routh's Criteria.
6) Numerical of Polar Plot.
7) Numerical of Root Locus.
8) Numerical of Bode plot.
9) Numerical of State space representations.
10) Numerical of Root Locus using MATLAB.

At least **six** exercises are expected.

TEXT BOOKS:

1. Control System Engineering, J. Nagrath and M.Gopal, New Age International Publishers, 5th Edition, 2007
2. Control System – Principles and Design, M. Gopal, Tata McGraw Hill, 2nd Edition, 2002.
3. Control Systems Engineering, S. K. Bhattacharya, Pearson.
4. Control System Engineering, Baxi and Goyal, Technical Publication, Pune.
5. Control Systems, Dhanesh N. Manik, Cengage Learning.
6. Control Systems -Theory & Application, Smarajit Ghosh, Pearson.
7. Control Systems, Anand Kumar, PHI.

REFERENCE BOOKS:

1. Automatic Control Systems, Benjamin. C. Kuo, Prentice Hall of India, 7th Edition, 1995.
2. Digital Control and State Variable Methods, M. Gopal, 2nd Edition, TMH, 2007.
3. Feedback and Control Systems, Stubberud, Schaum's Outline Series, Tata McGraw-Hill, 2007.
4. Linear Control System Analysis and Design, John J. D'azzo & Constantine H. Houpis, Tata McGrow-Hill, Inc., 1995.
5. Modern Control Systems, Richard C. Dorf & Robert H. Bishop, Addison – Wesley, 1999.
6. Modern Control Engineering, K. Ogata, Prentice Hall of India.
7. Control System Engineering Using MATLAB, S.N. Sinanandam, S.N. Deepa, Vikas Publication.
8. Digital Control System, V.I. George, C.P. Kurian, Cengage Learning.
9. Control Systems - Problem and Solutions, K.R. Varmah, McGraw Hill Education.

BEME603T: OPERATIONS RESEARCH (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week	Duration of Paper: 03 Hours
Tutorial: 1 Hour/Week	University Assessment: 80 Marks
	College Assessment: 20 Marks

Course Objectives and Expected Outcomes: The objectives of this course are to provide a formal quantitative approach to problem solving and perception about situations where such an approach is appropriate, to introduce some widely used mathematical models and to provide tools that students can use to solve management problems. After going through this course, students will gain proficiency with tools for optimization, simulation, including fundamental applications of those tools in industry in context of uncertainty and scarce or expensive resources.

UNIT – I **[8 Hrs.]**

Introduction to O. R. & basic O.R. Models, Characteristics, phases & Methodology of O.R., Limitations & Applications.

Linear Programming:- Introduction, Linear programming problem formulation, LPP Solution by Graphical Method, Simplex Method, Principle of Duality & Formulation of Model only, Sensitivity Analysis Concept Only.

UNIT – II **[8 Hrs.]**

Transportation Model – Introduction, Formulation, Optimal Solution by MODI method, Unbalanced Transportation Problem, Degeneracy, Transshipment Problem.

Assignment Model – Introduction, Variants of Assignment Problems.
Traveling Salesman Problem – Branch & Bound Technique.

UNIT – III **[8 Hrs.]**

Game Theory- Introduction, Minimax and Maximin, Criteria and Optimal Strategy, Solution of games with Saddle Points, Games without Saddle Points, 2x2 games, Dominance Principle, mx2 & 2xn games. (No Graphical Method).

Sequencing Model – Introduction, Sequencing Model: n job two machines problem, n job 3 machines problem, 2 jobs m machine problem.

Inventory Model: Inventory control costs, analysis of inventory models with deterministic demand (Single Product), ABC analysis.

UNIT – IV **[8 Hrs.]**

Network Model – Project Management, Formation of Network, CPM & PERT analysis, Probability of Completion of Project, Cost Analysis of Project, and Concept of Crashing.

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UNIT – V **[8 Hrs.]**

Replacement Model – Replacement Analysis – Replacement of items that deteriorated with time, Replacement of items that fails suddenly, Group Replacement.

UNIT – VI **[8 Hrs.]**

Queuing Theory, M/M/1 model (without derivation).

Simulations – Concept, applications in waiting line situations, inventory and network.

TEXT BOOKS:

1. Operation Research, D.S. Hira & P. Gupta, S. Chand Publications.
2. Operation Research, J. K. Sharma, Macmilan Publishers.
3. Operation Research, H. Taha, Dorling Kindersley.
4. Operation Research, R. D. Askhedkar & R.V. Kulkarni, Dhanpat Rai & Sons.

BEME604T: MECHATRONICS (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week	Duration of Paper: 03 Hours
Tutorial: 1 Hour/Week	University Assessment: 80 Marks
	College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to understand key elements of mechatronics systems, to identify various inputs and output devices in an automated system, to understand and draw ladder diagrams, to understand interfacing of input and output devices, to get awareness about actuating systems, microprocessors & microcontroller. At the end of this course students shall be able to understand the working of mechatronics systems & shall acquire the insight to build the mechatronics systems.

UNIT – I **[8 Hrs.]**

Introduction to mechatronics:

Review of sensors, transducers and solid state electronic devices (*Only review, no questions to be set on these topics*).

Scope and elements of mechatronics, mechatronics design process, measurement system, requirements and types of control systems, feedback principle, Basic elements of feedback control systems, Classification of feedback control system.

Examples of Mechatronics Systems such as Boat Autopilot, High-Speed Tilting trains, Automatic Car Park system, Coin counter, Engine management system, Antilock braking system (ABS) control, traffic controller, temperature controller, weigh-bridge, weather prediction, Automatic washing machine etc. General remarks on applications.

UNIT – II **[8 Hrs.]**

System Interfacing and Data Acquisition:

DAQs: Data acquisition systems (DAQS), data loggers, Supervisory control and data acquisition (SCADA), Communication methods.

I/O hardware and Software at the Microprocessor: Level and commutation, I/O operations, Data width, interfacing requirement, Buffers, Handshaking, Polling and interrupt, Digital communication, Parallel communication, Serial communication, Peripheral interface device (PIA), Analogue interfacing.

Analogue to Digital and Digital to Analogue Conversations: Introduction to digital signal processing (DSP), Data flow in DSPs, Block diagrams and typical layouts.

Components of interconnections and Impedance Matching: Impedance characteristics, Cascade connection of devices, Impedance matching in mechanical systems, interfacing microcontroller output with actuators.

Interfacing Motor Drives: Drives units- DC drives, Variable frequency drives (VFD), Scalar and Vector drives, Stepper motor driver and controller.

UNIT – III **[8 Hrs.]**

Actuating Systems:

Review of Mechanical Actuating Systems: Mechanical systems, Types of motion, Cams, Gears, Ratchet and Pawl, Belt & chain drives, Bearings, Preload, Mechanical aspects of motor selection. (*Only review, no questions to be set on these topics*)

Electrical Actuating Systems: Mechanical switches and relays, solenoids, state switches-solenoids, DC Servomotors, Stepper motor, Induction Motors, speed control , pulse four- quadrant servo drives, Pulse width modulation (PWM) frequency drive, vector drive.

Pneumatics & Hydraulic Actuating Systems: Pneumatics & Hydraulic Systems, directional control valves, pressure control valves, servo and proportional control valves, Process control valves, cylinder sequencing and cascade control, rotary actuators, Identifications of graphical symbols for Pneumatic and Hydraulic circuits.

UNIT – IV **[8 Hrs.]**

Digital logic: Number system, Logic gates, Boolean algebra, Karnaugh map, Applications of gates, Sequential logic.

Introduction – Components of Microprocessors: Number systems, arithmetic operations on binary numbers, 8-bit, 16-bit, 32-bit microprocessors.

8085 Microprocessor: Pin configurations of 8085, architecture of the execution unit, memory segmentation in 8085, architecture of bus interface unit of 8085, building of microprocessor subsystems.

UNIT – V **[8 Hrs.]**

Programmable Logic Controller: Introduction to PLCs, Basic structure of PLC, Principle of operation, input and output processing, PLC programming language, ladder diagram, ladder diagrams circuits, timer counters, internal relays, master control, jump control, shift registers, data handling, and manipulations, analogue input and output, selection of PLC for application.

Application of PLC control: Extending and retracting a pneumatic piston using latches, control of two pneumatic pistons, control of process motor, control of vibrating machine, control of process tank, control of conveyer motor etc.

UNIT – VI **[8 Hrs.]**

Introduction to SCADA: Functionality, applications, development, evaluation and benefits of SCADA.

Introduction to Electronics Interface Subsystems: Transistor- Transistor logic (TTL), Complimentary metal-oxide semiconductor (CMOS) interfacing, sensor interfacing, motor isolation schemes, buffer IC breakers, over current sensing, resettable fuses.

Introduction to Micro Electro Mechanical Systems (MEMS): Fabrication methods - Working and applications of MEMS based accelerometer, pressure sensor and gyroscope.

TEXT BOOKS:

1. Mechatronics - Integrated Mechanical Electronics System, K.P. Ramachandran, Wiley India Pvt. Ltd. New Delhi
2. Mechatronics & Microprocessors, K.P. Ramachandran, Wiley India Pvt. Ltd., New Delhi.
3. Programmable Logic Controllers, John W Webb and Ronald A Reis, Prentice Hall, Inc., 1999.
4. Mechatronics, Bolton W, Pearson Education, Second Edition, 1999.
5. Pneumatic Application, Kemprath Reihe, Wemer Depper and Kurt Stoll, Vogel Buch Verlag Wurzbutg, 1987.
6. An Introduction to MEMS Engineering, Nadim Maluf & Kirt Willams.
7. RF MEMS & their Applications, Vardhan, Willey India Pvt. Ltd.
8. MEMS: Introduction and Fundamentals, Mohamed gad-el-hak, CRC Press, 2nd ed.

REFERENCE BOOKS:

1. Pneumatic Application, Wemer Deppert and Kurt Stoll, Kemprath Reihe, Vovel Verlag , Wurzburg, 1976.
2. Pneumatic Tips, Festo K G, Festo, Germany, 1987.
3. Mechatronics, N. P. Mahalik, Mc Graw-Hill Education.
4. Mechatronic Systems Fundamentals, Rolf Isermann, Springer, 2003.
5. Mechatronics: Introduction, Robert H Bishop, Taylor and Francis, 2006.
6. Mechatronics System Design, D. Shetty, Cengage Learning (Indian Ed.)

BEME604P: MECHATRONICS (Practical)

CREDITS: 01

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	University Assessment: 25 Marks
	College Assessment:25 Marks

LIST OF PRACTICALS:

Minimum Eight practicals out of the following areas shall be performed:

1. Identification & study of solid state electronic devices.
2. Identification, study & demonstration of different sensors.
3. Identification, study & demonstration of different actuators.
4. Demonstration of working of various digital to analog and analog to digital Converters.
5. Development of ladder diagram, programming using PLC for any of the following.
    a) Motor start and stop by using two different sensors.
    b) Simulation of a pedestrian traffic controller.
    c) Simulation of four road junction traffic controller.
    d) Lift / elevator control.
    e) Washing machine control.
    f) Tank level control.
    g) Soft drink vending machine control
    h) Any other suitable application.
5. Trace, interpret and demonstrate working of electro pneumatic systems.
6. Trace, interpret and demonstrate working of electro hydraulic systems.

BEME605T: DYNAMICS OF MACHINES (Theory)

CREDITS: 04

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week	Duration of Paper: 03 Hours
Tutorial: 1 Hour/Week	University Assessment: 80 Marks
	College Assessment: 20 Marks

Course Objectives and Expected Outcomes: This course is designed to understand the method of dynamic force analysis of machinery, the concept of vibratory systems and their analysis and also to study the effect of undesirable effects of unbalances in rotors and engines.

UNIT – I **[8 Hrs.]**

Concepts in machine element dynamics. D'Alembert principle. Application of these approaches for simple two degree of freedom systems. Simple precession and gyroscopic couple. Gyroscopic effect on airplane, ship, vehicles and grinding mills.

UNIT – II **[8 Hrs.]**

Dynamic force analysis of planar linkages such as four bar chain and reciprocating mechanism by graphical method, virtual work method. Cam dynamics and jump-off phenomenon.

UNIT – III **[8 Hrs.]**

Static & Dynamic balancing in rotating machines. Balancing machines and field balancing by vector diagram.
Balancing in reciprocating mechanism.

UNIT – IV **[8 Hrs.]**

Turning moment Vs crank angle diagram for single- cylinder and multiple-cylinder engines, punching machines etc. Flywheel selection.
Speed governors, centrifugal and inertia type, Watt, Portal, Proel, Hartnell governors, operating characteristics of governors.
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UNIT – V **[8 Hrs.]**

Derivation of equation of motion for vibratory system. Free vibration of single-degree-of- freedom system with and without damping. Logarithmic decrement and damping estimation. Forced vibration of single-degree-of-freedom system and vibration isolation, whirling of shaft and critical speed of rotors.

UNIT – VI **[8 Hrs.]**

Equation of motion for two-degree-of-freedom system. Natural frequencies and mode shapes, vibration absorber. Torsional oscillation of two-disc and three disc rotors. Introduction to FFT analyzer for vibration measurements.

TEXT BOOKS:

1. Mechanical Vibrations, S. S. Rao, Addison Wesley Publishing.
2. Mechanical Vibrations, V. P. Singh, Dhanpat Rai & Sons.
3. Mechanical Vibrations, G. K. Grover, Nem Chand & Bros.
4. Fundamentals of Mechanical Vibration, Graham Kelly, Tata McGraw Hill.
5. Theory of Machines, Jagdish Lal, Metropolitan Publishers.
6. Theory of Machines, Rattan S. S, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
7. Vibration and Noise for Engineering, Pujara, K, Dhanpat Rai and Company.
8. Theory of Machine, Thomas Bevan, Pearson Publications.
9. Mechanics of Machines, V. Ramamurti, Narosa Publications.
10. Mechanism & Machine Theory, A.G. Ambekar, PHI Publication.

REFERENCE BOOKS:

1. Theory of Mechanisms and Machines, Ghosh A. and Mallick A.K., Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
2. Theory of Machines and Mechanisms, Shigley J.E. and Uicker J.J.,McGraw-Hill, Inc., 1995.
3. Mechanism and Machine Theory, Rao J.S. and Dukkipati R.V., Wiley-Eastern Limited, New Delhi, 1992.
4. Mechanics of Machines, John Hannah and Stephens R.C., Viva Books.
5. Theory of Machines, Sadhu Singh, Pearson Education.

BEME605P: DYNAMICS OF MACHINES (Practical)

CREDITS: 01

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	University Assessment: 25 Marks
	College Assessment:25 Marks

LIST OF PRACTICALS:

Minimum eight out of the following shall be performed:

1. Determination of jump-of speed of a typical cam- follower system**.**
2. Dynamic balancing of rotating masses(study of wheel balancing machine along with performance by visiting any automobile workshop).
3. Balancing of reciprocating mechanism.
4. Critical speed of shafts.
5. Performance characteristics of Gyroscope.
6. Free vibration of single DOF and two DOF spring mass system.
7. Natural frequency determination of cantilever beam.
8. Damping determination through free vibration logarithmic decay of a simple damped system.
9. Natural frequency determination of two and three rotor system.
10. Torsional vibration of bifilar or trifilar pendulum.
11. Transmissibility of single degree of freedom system
12. Dynamic vibration absorber.
13. Dynamic force analysis of four bar mechanisms.
14. Dynamic force analysis of slider crank mechanism.
15. Flywheel selection and parameter design for a typical multi-cylinder engines.
16. Performance characteristics of governors.
17. Study of any mechanism in workshop/industry..
18. Use of FFT analyzer for determination of natural frequencies of machine components.

BEME606T **FUNCTIONAL ENGLISH**

BEELE607T	**FUNCTIONAL ENGLISH**	**L = 2**	**T = 0**	**P = 0**	**Credits = 2**
Examination Scheme	College Assessment	University Examination		Total	Univ. Exam. Duration
	10	40		50	2 Hrs

Syllabus

Total Credits: 02

Teaching Scheme **Examination Scheme**
Theory: 2 hrs per week **T (University): 40 marks**
Duration of University Examination :2 hrs **T (Internal): 10 marks**

Objective: At the end of the semester, students will have enough confidence to face competitive examinations (IELTES/ TOEFL/CAT/ MAT/ XAT/SNAP/GMAT/GATE etc.)to pursue masters degree. They will also acquire language skills required to write their Reviews/Projects/Reports. They will be able to organize their thoughts in English and hence face job interviews more confidently.

Scope: The Curriculum designed is student –centered and it is guidance for their career

Course Structure

Unit 1. Functional Grammar: (4 hours**)**
Common errors, Transformation of Sentences, Phrases, Idioms & Proverbs.
[50 sentences of common errors, 50 examples of Transformation of Sentences, (5 each type), 50 noun/prepositional phrases, 50 idioms/proverbs]

Unit II. English for Competitive Exams & Interview Techniques: **(** 6 hours)

IPA (vowel & consonant phonemes), Word building (**English** words /phrases derived from other languages), Technical Jargons, Synonyms/Antonyms, Analogies, Give one word for, Types & Techniques of Interview

Assignment : [25 Words for teaching IPA, 25 words/phrases of foreign origin, 25 technical jargons, 25 words for Synonyms/ Antonyms, 25 words for Analogies, 50 examples of give one word for]

Unit III. Formal Correspondence (4 hours)

Business Letters, e-mail etiquettes [Orders, Complaints , Enquiries, Job applications and Resume Writing ,Writing Memorandum, Circulars, notices]

Unit IV. Analytical comprehension: (4 hours)
[Four fictional & four non-fictional unseen texts]

Unit V. Technical & Scientific Writing: (6 hours)
Features of Technical Writing, Writing Scientific Projects, Technical Report writing, Writing Manuals, Writing Project Proposals, Writing Research papers.
Assignment: (Any one project/review as assignment)

RECOMMENDED BOOKS

- **Reference Books:**

1. Effective technical Communication by Barun K. Mitra, Oxford University Press,
2. *Technical Communication-Principles and Practice* by Meenakshi Raman & Sharma, Oxford University Press, 2011, ISBN-13-978-0-19-806529-
3. *The Cambridge Encyclopedia of the English Language* by David Crystal , Cambridge University Press
4. *Contemporary Business Communication* by Scot Ober , Published by Biztantra,
5. *BCOM- A South-Asian Perspective* by C.Lehman, D. DuFrene & M. Sinha, Cenage Learning Pvt. Ltd.2012
6. *Business English*, by Dept of English, University of Delhi, Published by Dorling Kindersley (India), Pvt .Ltd.,2009, ISBN 978 81 317 2077 6
7. *How to Prepare a Research Proposal*: Guidelines for Funding and Dissertations in the Social and Behavioral Sciences by Krathwohl & R David
8. *Technical Writing- Process and Product* by Sharon J. Gerson & Steven M. Gerson, 3rd edition, Pearson Education Asia, 2000
9. *Developing Communication* skills by Krishna Mohan & Meera Banerjee

EVALUATION PATTERN:

Internal Examination: Weightage = 10 marks
Written Examination: 05 marks
Project Seminar : 05 marks

External Examination: Weightage = 40 marks

Question pattern for end semester examination

Unit No	Q. No	Question type	No. of Questions	Weightage
Unit 1	1(A) 1(B) 1(C)	objective objective objective	3 out of 5 3 out of 5 4 out of 6	3+3+4=10
Unit 2	2 (A) 2(B) 2(C)	objective objective subjective	3 out of 5 3 out of 5 1 (no choice)	3+3+4=10
Unit 3 & Unit4	3 (A) 3(B)	Subjective subjective	1 set (out of 2 sets) 1(no choice)	5 5
Unit 5	4(A) 4(B)	subjective subjective	1 out of 2 1 out of 2	5 5

BEME607P: COMPUTER APPLICATIONS – II (Practical)

CREDITS: 04

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	University Assessment: 50 Marks
Tutorial: 2 Hour/Week	College Assessment:50 Marks

Course Objectives and Expected Outcomes: This course is designed to give theoretical & practical exposure to DBMS. During this course, students will understand the concepts & applications of DBMS.

An Introduction to DBMS, concept and meaning, Disadvantages of file systems. Advantages and Disadvantages of DBMS. Database languages, database administrator & user, system structure.

Entity Relationship Model: Entities and Entity sets, Relationship and sets, Mapping constraints, Keys, E-R diagrams, E-R diagrams diagram to table, Generalization, Aggregation, Design of an E-R database scheme.

Relational database & SQL, set operations, aggregate functions Nested sub queries, derives relations. Modification of the database, Data Definition language (DDL), Embedded SQL.

LIST OF PRACTICALS:

At least eight Practicals in applications like Material Management, Inventory Management, Office automation etc. based on above syllabus shall be conducted using suitable DBMS packages like ORACLE, MS ACCESS etc. or relevant freeware/s.

Note:

During University practical examination of 50 marks, students are expected to workout problem/s of total 30 marks using DBMS software in two hours duration. Viva-voce of 20 marks shall be conducted during University practical examination.

TEXT BOOKS:

1. An Introduction to Database System, C.J. Date, Perarson
2. Database and System Concept, A Silberschatz, H F Korth, A Sudarshan., TMH publications
3. User/Command/Tutorial manuals of relevant softwares.

BEME608P: INDUSTRIAL CASE STUDY

CREDITS: 02

Teaching Scheme	**Examination Scheme**
Practical: 02 Hour/Week	College Assessment: 50 Marks

Course Objectives and Expected Outcomes: This course is designed to acquaint the students with various industrial/organizational problems and how they can be solved using methods/techniques/theories etc. studied in curriculum.

Industrial case study should be based on the study of some specific case/issue/problem related to any industrial/business establishment. Data should be collected from industry or organization with objective of studying some specific case/issue/problem. The collected data should be analyzed using one or more theories studied in curriculum. The results should be worked out and conclusions should be drawn. The industrial case study can be also be based on the study of report prepared by any industry/business organization related to issues/problems. Group of students (Max 09 & Min 05) can be considered for this study. A report should be submitted. The report should consist of the problem/issue identified, methodology of data collection, data collected, methods of analysis, results and conclusions. Student is expected to give presentation based on this report.