Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Bachelor of Engineering (Mechanical Engineering)

VI Semester B.E. (Mechanical Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme								
		Hours per week			No. of Credits	Theory					Practical			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks University Assessment	Max. Marks College Assessment	Total Marks	Min. Passing Marks	Max. Marks University Assessment	Max. Marks College Assesment	Total Marks	Min. Passing Marks
BEME601T	Energy Conversion- I	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME602T	Control Systems Engineering	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME603T	Operations Research	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME604T	Mechatronics	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME604P	Mechatronics	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME605T	Dynamics of Machines	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME605P	Dynamics of Machines	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME606T	Functional English	02	-	-	02	02	40	10	50	20	-	-	-	-
BEME607P	Computer Applications - II	-	02	02	04	-	-	-	-	-	50	50	100	50
BEME608P	Industrial Case Study	-	-	02	02	-	-	-	-	-	-	50	50	25
Total		**17**	**07**	**08**	**-**	**-**	**440**	**110**	**550**	**-**	**100**	**150**	**250**	**-**
Semester Total		**32**			**30**	**800 Marks**								

Functional English (BEME606T) subject pertains to Board of Studies in Applied Sciences & Humanities and all the remaining subjects pertain to the Board of Studies in Mechanical Engineering. Mechatronics (BEME604T/P) subject can also be taught by a teacher from Electronics/Instrumentation/Mechatronics/relevant disciplines.

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.

.

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	**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 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.

.

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.

.

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
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 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.
.

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.