Bachelor of Technology – Mechanical & Automation Engineering

FLEXILEARN

-Freedom to design your degree

Programme Structure

Curriculum & Scheme of Examination

2014

AMITY UNIVERSITY CHHATTISGARH

RAIPUR

B.Tech-Mechanical & Automation Engineering

Programme Structure

FOURTH SEMESTER

Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credits
MAE2401	Dynamics of Machines	3	1	-	4
MAE2402	Manufacturing Machines	3	-	-	3
MAE2403	Theory of Metal Forming	3	-	-	3
MAE2404	Electrical Machines	3	-	-	3
MAE2405	Dynamics of Machines Lab	-	-	2	1
MAE2406	Manufacturing Machines Lab	-	-	2	1
MAE2407	Electrical Machines Lab	-	-	2	1
Concentration Electives					**4**
MAE2408	Numerical Analysis & Programming	3	-	-	3
MAE2409	Numerical Analysis & Programming Lab	-	-	2	1
MAE2410	Gas Dynamics	3	1	-	4
Open Electives					**4*+3**
CSS2251	Presentation Skills*	1	-	-	1
BEH2451	Stress and Coping Strategies*	1	-	-	1
	Foreign Language – IV*	2	-	-	2
LAN2451	French-IV				
LAN2452	German-IV				
LAN2453	Spanish-IV				
LAN2454	Russian-IV				
LAN2455	Chinese-IV				
LAN2456	Portuguese-IV				
LAN2457	Korean-IV				
LAN2458	Japanese-IV				
	TOTAL				**27**

SUMMER INTERNSHIP-I

   * Compulsory

DYNAMICS OF MACHINES

Course Code: MAE2401   **Credit Units: 04**

Module 1
 Static Force Analysis: Static force analysis of planer mechanisms, Free body diagrams, dynamic force analysis including inertia and frictional forces of planer mechanisms
Inertia forces: D-Alembert"s Principle, Velocity and acceleration of piston, Torque exerted on the crank shaft when friction and inertia of moving parts are neglected, Forces on the reciprocating parts of an engine considering friction and inertia of moving parts, Turning moment on crank shaft, Dynamically equivalent system, Torque exerted on the crank shaft, considering the weight of the connecting rod.

Module 2.
Balancing of rotating masses: Balancing of single rotating mass, Balancing of several masses rotating in the same plane, Balancing of several masses rotating in different planes.

Balancing of reciprocating masses: Balancing of reciprocating engine, Partial balancing of primary force, Partial balancing of locomotives, Variation of tractive force, swaying couple, hammer blow, coupled locomotive, primary balance of multi-cylinder inline engine, Secondary balance of multi-cylinder in line engines, Method of direct and reverse cranks, V-engines balancing.

Module 3.
Governors: Types of Governor, Watt Governor, Porter governor, Proell Governor, Hartnell Governor, Wilson-Hartnell governor, Sensitivity, Stability, Isochronism, Hunting, Governor Effort and Power, controlling force

Module 4.
Gyroscopic effect and Gyroscope: Spinning and precession, gyroscopic couple, Effect of gyroscopic couple on the stability of automotive vehicles: Stability of four wheelers, Stability of two wheelers, Gyroscopic effects on ships and aero planes.

Module 5.
Vibration: Vibration analysis of SDOF systems, natural, damped, forced vibrations, base-excited vibrations, transmissibility ratio

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
- PL Ballaney, Theory of Machines,
- Hams Crone and Roggers, Theory of Machines
- Shigley, Theory of Machines
- J. Lal, Theory of Machines
- SS Rattan, Theory of Machines
- Ghosh and Mallick, Mechanisms and Machines, EWP publication.
- R.S. Khurmi, Theory of Machine, S. Chand.

MANUFACTURING MACHINES

Course Code: MAE2402   **Credit Units: 03**

Course Objective:
This is a new developmental graduate course for students interested in learning how to design, analyze and build specialty manufacturing process machines. It anticipated that this course would become part of the new manufacturing emphasis area in mechanical engineering.

Course Contents:
Module I: Introduction to Machine Tools
Classification of machine tools, kinds of motion in machine tool operations, definition of cutting speed, feed and depth of cut.

Module II: Lathe
Classification and various parts of Lathe, specification, Description of important mechanism viz. apron, tail stock, head stock, work holding, devices and operations, e.g. taper, turning, eccentric turning and screw-cutting, Geometry of a single point cutting tool. Calculation of machining time, Capstan and turret lathe

Module III: Drilling Machine
Geometry and nomenclature of a twist drill, specification and classification of drilling machines, cutting speed, feed, depth of cut and calculation machining time in drilling, tool holding devices, different types of operations performed on a drilling machine.

Module IV: Milling Machine
Classification, up milling and down milling, dividing Head, different types of operations – simple, compound and differential indexing, slab milling, spiral milling, slot milling, T-slot milling and end milling.

Module V: Shaper, Slotter & Planner
Principal part of a shaper, classification, Quick Return mechanism, table feed mechanism of a shaper, Operations, e.g. horizontal, vertical and inclined shaping, difference between a shaper, planer and slotter, cutting speed, feed, and depth of cut and calculation of machining time in shaping.

Module VI: Grinding Machines
Construction and specification of a grinding wheel, wheel turning and dressing, Grinding machines surface, cylindrical and center less grinding.

Module VII: Special Machines
Horizontal and vertical boring machines, Gear Geometry, Gear generation and hobbing; Lapping, honing and super finishing processes.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- P.N. Rao, "Manufacturing Technology: Metal Cutting & Machine Tools", Tata McGraw Hill, Delhi, 2004.
- B.S. Raghuwanshi, "Workshop Technology", Vol.2, Dhanpat Rai & Sons, 2003.
- Hazra Chandhari S.K., "Elements of Workshop Technology", Vol.2, Media Promoters, 2003.

References:
- P.C. Sharma, "A Text Book of Production. Engineering", S. Chand, New Delhi, 2004.
- Bawa H.S., "Workshop Technology", Vol.2, Tata McGraw Hill, 2004.
- Juneja & Shekhon, "Fundamental of Metal Cutting", New Age Publications
- S.F. Krar Stevan F. and Check A.F., "Technology of M/C Tools", McGraw Hill Book Co., 1986.
- Kibbe Richard et al, "M/c Tool practices", Prentice Hall India, 2003.
- Bangalore HMT, "Production Technology", Tata McGraw Hill, 1980.
- R.K. Jain, "Production Technology", Khanna Publishers
- Gerling Heinrich, "All about Machine Tools", New Age Publication, 2003.

THEORY OF METAL FORMING

Course Code: MAE2403   **Credit Units: 03**

Course Objective:
The objective of this course is to introduce the fundamentals of basic manufacturing processes (solidification process, heat treatment, deformation processes, material removal processes, and joining processes). The students are expected to be able to select, analyze and design basic manufacturing processes for product development.

Course Contents:
Module I: Introduction
Review of tensile test, True stress and true strain, Yielding criteria for ductile metals, Yield locus, Plastic stress-strain relations-Levymises equation, prandtl-Reuss equations.

Module II: Plastic deformation
Crystal Geometry, Lattice defects, Deformation by slip, Shear Stress required to cause slip in a perfect Crystal, Deformation by twinning, Fracture, Types of Fracture, Creep Failure.

Module III: Introduction to metal working
Classification of metal working processes-Cold working, Hot working, Effect of variables on metal working processes, Methods of Analysis of metal working processes.

Module IV: Forging
Classification of Forging Processes, Forging equipment, Open die forging, Closed die forging, Load calculation in Plane strain forging, Forging defects.

Module V: Rolling
Rolling Mills, Hot rolling, Cold rolling, Forces and Geometrical Relationships in Rolling, Rolling load & torque, rolling defects.

Module VI: Extrusion
Methods of Extrusion, Hot Extrusion, Cold Extrusion, Analysis of Extrusion processes, Effect of Variables on Extrusion pressure, Extrusion defects.

Module VII: Sheet metal forming
Forming Methods, Forming Operations-Shearing, Blanking, Bending, Stretch Forming, Deep Drawing, Stresses developed in Deep Drawing, Defects in Formed Parts.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

☐ Mechanical Metallurgy by George E. Dieter: Mc Graw-Hill Book Company
☐ Metal working by Surinder Kumar, Dhanpat Rai & Sons

ELECTRICAL MACHINES

Course Code: MAE2404   **Credit Units: 03**

Course Objective:
Electrical Machines provides the backbone for successful and uninterrupted smooth functioning of any industry. Knowledge of this subject in any engineering branch is vital in process industry. The course covers the machines e.g. Motors & generators characteristics and classifications related to mechanical & automation as well as recent development engineering applications. Successful completion of this course will be very helpful for the students who wish to join challenging industry.

Course Contents:

Module I
Introduction to Subject, Some important fundamentals, Electrical Power generation, Utilization & distribution facts & figures. Simple Loop Generator, D C Machines, Construction Features, Principle of Operation.

Module II
DC Generator Analysis & DC Motor, Classification & Characteristics & Analysis. Speed Torque Characteristics, Speed control of D C Motor. Application of D C Motor. Starters.

Module III
A C Machines, 3 phase IM, Revolving Magnetic field theory, IM as a transformer, Equivalent Circuit. 3 phase Synchronous Machines, Synchronous Motor, Synchronous Generator, Equivalent Ckt.

Module IV
Single phase Induction Motor, Double Revolving Field theory, Different types of 3 phase IM. Characteristics & typical Applications. Fractional Kilo Watt Hour Motor, Stepper Motor, Hysterisis Motor, A C Series Motors, Universal Motors.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- I J Nagrath & D P Kothari. "Electrical Machines". TMH
- Irvin Kosow, "Electrical Machines & Transformers", PHI.

References:
- B L Theraja "Electrical Engineering".

DYNAMICS OF MACHINES LAB

Course Code: MAE2405   **Credit Units: 01**

List of Experiments:
1. To study gyroscopic effects through models
2. To determine gyroscopic couple on Motorized Gyroscope.
3. To determine and verify the whirling speed of a shaft-disc system
4. To determine the damping factor for a given horizontal vibration set up
5. To perform experiment on Watt and Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.
6. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
7. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.
8. To perform the experiment for static balancing on static balancing machine.
9. To perform the experiment for dynamic balancing on dynamic balancing machine.
10. To determine mass moment of inertia of a flywheel.
11. To perform wheel balancing
12. To plot pressure distribution curves on a journal bearing

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

MANUFACTURING MACHINES LAB

Course Code: MAE2406   **Credit Units: 01**

Course Contents:

1. Operations on the Lathe Machine.

2. Operations on the Shaper Machine.

3. Operations on the Planner Machine.

4. Operations on the Drilling Machine.

5. Operations on the Grinding Machine.

6. Operations on the Milling Machine.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

ELECTRICAL MACHINES LAB

Course Code: MAE2407   **Credit Units: 01**

Course Contents:

S. NO.	NAME OF THE EXPERIMENTS
1.	Speed Control of DC Shunt Motor
2.	To obtain magnetization characteristics of 1) Separately excited DC Generator 2) Shunt Generator
3.	To obtain the load characteristics 1) DC Shunt Motor 2) Cumulative Compound generator
4.	To conduct Swinburne Test on a DC. Shunt Motor and hence obtain its efficiency at full load.
5.	To perform No Load Test and blocked rotor test on a three phase Induction motor and hence determine its equivalent circuit parameters.
6.	To perform load test on a three phase Induction Motor and obtain its various performance characteristics.
7.	Retardation Test on a three phase induction motor and calculate its moment of inertia.
8.	To perform No Load and Blocked Rotor Test on a single phase Induction motor and hence determine its equivalent circuit parameters.
9.	To perform open circuit and short circuit test on a three phase alternator and hence determine its voltage regulation by synchronous Impedance Method.
10.	To obtain V curves of a three phase synchronous motor at no load.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

NUMERICAL ANALYSIS AND PROGRAMMING

Course Code: MAE2408   **Credit Units: 03**

Course Objective:
This course deals with the techniques of numerical analysis, which gives the solution to applied problem when ordinary analytical method fails. Emphasis is given on computer programming also so that the given techniques can be used in design of engineering and scientific problems.

Course Contents:

Module I: Solution of Algebraic and Transcendental Equation
Error in a series approximation, Bisection Method, Iteration method, Method of false position, Newton-Raphson method
Solutions of Simultaneous equation
Gauss elimination method, Jacobi iteration method, Gauss Seidal method

Module II: Interpolation
Finite Differences, Difference tables
Polynomial Interpolation**:** Newton‟s forward and backward formula
Central Difference Formulae: Gauss forward and backward formula.
Interpolation with unequal intervals: Lagrange‟s Interpolation, Newton Divided difference formula

Module III: Numerical Integration and Differentiation
Introduction, Numerical differentiation Numerical Integration: Trapezoidal rule, Simpson‟s 1/3 and 3/8 rules.

Module IV: Solution of differential Equations
Euler‟s Method, Runga-Kutta Methods.

Module V: Statistical Computation
Frequency chart, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves etc, Data fitting with Cubic splines.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- Rajaraman V, "Computer Oriented Numerical Methods", Pearson Education
- Gerald & Whealey, "Applied Numerical Analyses", AW
- Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int.
- Grewal B S, "Numerical methods in Engineering and Science", Khanna Publishers, Delhi

References:
- T Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods, TMH
- Pradip Niyogi, "Numerical Analysis and Algorithms", TMH
- Francis Scheld, " Numerical Analysis", TMH
- Sastry S. S, "Introductory Methods of Numerical Analysis", Pearson Education.
- Gupta C.B., Vijay Gupta, "Introduction to Statistical Methods", Vikas Publishing.
- Goyal, M, "Computer Based Numerical and Statistical Techniques", Firewall Media, New Delhi.

NUMERICAL ANALYSIS & PROGRAMMING LAB

Course Code: MAE2409   **Credit Units: 01**

Software Required: Turbo C/C++

Course Contents:

Assignments will be provided for the following:

1. Analysis of various numerical and statistical techniques

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

GAS DYNAMICS

Course Code: MAE2410   **Credit Units: 04**

Course Objective:
To understand the basic difference between incompressible and compressible flow.
To understand the phenomenon of shock waves and its effect on flow.
To impart knowledge to the students on compressible flow through ducts

Module 1
BASIC CONCEPTS AND ISENTROPIC FLOWS: Fundamentals of thermodynamics , reversible & irreversible process, adiabatic & isentropic process ,Properties of atmosphere, Velocity of sound, Mach angle, Mach number, Mach waves and Mach cone, wave motion Energy and momentum equations of compressible fluid flows Stagnation states, Effect of mach number on compressibility , Use of Gas tables

Module 2
ISENTROPIC THROUH VARIABLE DUCTS: Comparison of isentropic & adiabatic process, Mach number variation Stagnation & Critical state, Area ratio as function of mach number, Impulse function & mass flow rate, Flow through nozzle & diffuser, condition of maximum discharge , use of gas table.

Module 3
FLOW THROUGH CONSTANT AREA DUCTS WITH FRICTION : Fanno curve , Fanno flow equation   solution of Fanno flow equation, variation of flow properties ,   Use of   Fanno tables and charts .
FLOW THROUGH CONSTANT AREA DUCTS WITH FRICTION : Rayleigh curve , Rayleigh flow equation , Rayleigh flow relation , variation of flow properties , Condition of maximum heat transfer ,Use of Rayleigh tables and charts .

Module 4
NORMAL SHOCKS : Development of shock waves, refraction waves, governing equation,, Prandtl'-Meyer Relation, Static Pressure ratio & temperature ration across the shock, Ranking-Hugoniot relations, increase in entropy, change in stagnation pressure across the shock, strength of shock waves, use normal shock tables & charts

Module 5
OBLIQUE SHOCKS: Nature of flow through oblique shock wave , fundamental relation, Prandtl relation , Ranking-Hugoniot relations, variation of flow properties , oblique shock relation from normal shock equations. use oblique l shock tables & charts

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Books
Fundamental of compressible Flow by S.M Yahya, **New Age International**