PAAVAI ENGINEERING COLLEGE

(AUTONOMOUS)

B.E. MECHATRONICS ENGINEERING

REGULATIONS 2016

(CHOICE BASED CREDIT SYSTEM)

CURRICULAM

SEMESTER III

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA16301	Transforms and Boundary Value Problems	3	2	0	4
2	PC	MT16301	Engineering Metrology	3	0	0	3
3	PC	MT16302	Fluid Mechanics and Machinery	3	0	0	3
4	PC	MT16303	Digital Electronics	3	2	0	4
5	PC	MT16304	Kinematics of Machinery	3	2	0	4
6	ES	EE16305	Electrical Machines and Drives	3	0	0	3
Practical							
7	PC	MT16305	Fluid Mechanics and Machinery Laboratory	0	0	2	1
8	PC	MT16306	Computer Aided Machine Drawing	0	0	2	1
9	ES	EE16306	Electrical Engineering Laboratory	0	0	4	2
10	EEC	EN16301	Business English Course Laboratory	0	0	2	1
			TOTAL	**18**	**6**	**10**	**26**

SEMESTER IV

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA16404	Numerical Methods	3	2	0	4
2	PC	MT16401	Dynamics of Machinery	3	2	0	4
3	PC	MT16402	Control System Engineering	3	0	0	3
4	PC	MT16403	Mechanics of Solids	3	2	0	4
5	PC	MT16404	Production Technology	3	0	0	3
6	ES	EE16410	Microprocessors and its Applications	3	0	0	3
Practical							
7	ES	EE16411	Microprocessors Laboratory	0	0	2	1
8	PC	MT16405	Production Technology Laboratory	0	0	2	1
9	PC	MT16406	Machine Dynamics Laboratory	0	0	2	1
10	EEC	MT16407	Mini Project	0	0	2	1
			TOTAL	**18**	**6**	**8**	**25**

SEMESTER III

MA16301 **TRANSFORMS AND BOUNDARY VALUE PROBLEMS (COMMON TO ALL BRANCHES)** **3 2 0 4**

COURSE OBJECTIVES

- To introduce fourier series analysis which is central to many applications in engineering apart from solving boundary value problems.
- To acquaint the student with fourier transform techniques used in many engineering systems..
- To familiarize effective application of mathematical tools for the solutions of partial differential equations that model several physical processes.
- To apply one dimensional equation of heat conduction and study about wave equation.
- To learn and apply Z transform techniques for discrete time systems.

UNIT I FOURIER SERIES 15

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 15

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 15

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard four types of first order partial differential equations - Linear partial differential equations of second and higher order with constant, coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 15

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 15

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL PERIODS 75

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- comprehend fourier series, their different possible forms and the frequently needed practical harmonic analysis from discrete data.
- describe the concept of a function as a double integral under certain conditions and apply in the fourier transform pair and their properties.
- solve certain boundary value problems and apply the methods and results in engineering applications.
- employ partial differential equations to solve one dimensional wave and heat equations.
- demonstrate the knowledge of differential equations gained and solve them using Z transforms.

TEXT BOOKS

1. Veerarajan T., “Transforms and Partial Differential Equations”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G “Advanced Mathematics for Engineering Students” ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998

REFERENCES

1. Larry C. Andrews, Bhimsen K. Shivamoggi, “Integral Transforms for Enginears”, SPIE Optical Engineering press, Washington USA (1999).
2. Ramana.B.V., “Higher Engineering Mathematics”, Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
3. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig., “Advanced Engineering Mathematics” 10th Edition,Wiley Publications
5. Ray Wylie C and Barrett.L.C, “Advanced Engineering Mathematics”, Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

WEB LINKS

1. https://www.youtube.com/watch?v=coe-UA5ONI0
2. https://www.youtube.com/watch?v=gZNm7L96pfY
3. http://172.16.100.200/NPTEL/displayweb.html?type1=111103021%2F35.pdf
4. https://www.youtube.com/watch?v=4GHY8sRKPaU
5. http://172.16.100.200/NPTEL/displayweb.html?type1=111104031%2Flectures.pdf%23page%3D101.

MT16301 ENGINEERING METROLOGY 3 0 0 3

COURSE OBJECTIVES

- To describe the concept of metrology.
- To explain about metrology instruments and application for various measurements.
- To discuss the concept of computer applications in metrology.
- To acquire the principles of various Inspection, Instruments and Methodology.
- To develop the knowledge in the area of non-contact inspection.

UNIT I BASIC CONCEPTS AND COMPARATORS 9

Basic concept – Legal metrology – Precision – Accuracy – Types of errors – standards of measurement –principle traceability – interchangeability and selective assembly, gauge blocks, limit gauges – fits and tolerances– tailor's of gauge design. Comparators: Mechanical, Electronic, optical and Pneumatic – Automatic gauging.

UNIT II ANGULAR MEASUREMENT AND SURFACE FINISH MEASUREMENT 9

Angular measurement: sine bar – Autocollimator, optical projectors: profile projectors –toolmakers microscope, measurement of surface finish: Terminology – roughness – waviness –analysis of surface finish – stylus probe instrument –Talysurf.

UNIT III SCREW THREAD AND GEAR METROLOGY 9

Screw thread metrology: errors in thread – pitch error – drunkenness – measurement of various elements thread – two and three wire method – best wire size – Thread gauges – floating carriage micrometer. Measurement of gears – Terminology – measurement of various elements of gear – tooth thickness – constant chord and base tangent method – Parkinson Gear Tester.

UNIT IV OPTICAL METROLOGY 9

Laser Metrology: LASER interferometer – constructional features, sources of error, measurement of positional error, straightness and flatness of machine tools – LASER Alignment Telescope – LASER Micrometer – LASER Triangulation technique – in process and on line measurement–white light interferometer.

UNIT V ADVANCES IN METROLOGY 9

Coordinate measuring machine (CMM): Constructional features – types and applications. Computer Aided Inspection: Machine Vision system– Image processing.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- demonstrate different measurement technologies and to make use of them in Industrial Components.
- compute angular measurement and surface finish measurement.
- improve knowledge on screw thread metrology.
- describe the concept of laser metrology.
- illustrate Coordinate measuring machine.

TEXT BOOKS

1. Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.
2. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.

REFERENCES

1. Connie Dotson, et al., “Fundamentals of Dimensional Metrology”, Thomas Asia, Singapore, First print, 2003.
2. Doeblin E.O., “Measurement System Applications and Design” First Edition, 1990.
3. Groover M.P., “Automation, Production System and Computer Integrated Manufacturing “, Prentice – Hall, New Delhi, 2003.

WEB LINKS

1. http://nptel.ac.in/courses/112102103//Module%20G/Module%20G(2)/p2.htm
2. https://en.wikipedia.org/wiki/Computer-aided_inspection

MT16302 FLUID MECHANICS AND MACHINERY 3 0 0 3

COURSE OBJECTIVES

- To acqurie the basic concepts of fluid mechanics for thorough understanding of the properties of fluids.
- To describe the dynamics of fluids through the control volume approach.
- To construct the concepts of dimensionless parameters and its applications.
- To explain the working principles of pumps and turbines, also their applications.
- To describe and learn the working of reciprocating and rotodynamic hydraulic machines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8

Units and dimensions-Classification of fluids-Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 8

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV HYDRAULIC PUMPS 10

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle -work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

UNIT V HYDRAULIC TURBINES 10

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines –governing of turbines.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- list the fundamentals of fluid mechanics, including the basics of hydraulics, types of fluids- water, oils and its uses along with fluid properties.
- investigate the fluid flow phenomena with the application of momentum and energy equation.
- improve dimensional analysis and to learn the several non-dimensional numbers with real time applications.
- acquire knowledge about the working principle of turbo machinery.
- distinguish the different types of pumps, fluid machineries and its working principles.

TEXT BOOKS

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, Laxmi publications, New Delhi,(2010)
2. Modi P.N and Seth S.M, “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi (2004).

REFERENCES

1. Som, S.K. and Biswas, G., “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw-Hill, New Delhi, 2nd Edition, (2007).
2. Kumar. K.L., “Engineering Fluid Mechanics”, (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, (1995).
3. Graebel.W.P, “Engineering Fluid Mechanics”, Taylor Francis, Indian Reprint, (2011).
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
5. Rathakrishnan. E, “Fluid Mechanics”, Prentice Hall of India (II Ed.), (2007)

WEB LINKS

1. www.mechanical.in/fluid-mechanics-and-machinery
2. http://nptel.ac.in/courses/105101082/1

MT16303 DIGITAL ELECTRONICS 3 2 0 4

COURSE OBJECTIVES

- To describe the fundamentals of digital logic and minimization technique
- To illustrate the students with various number systems and codes
- To formulate the methods for simplifying boolean expressions
- To justify the formal procedures for the analysis and design of combinational and sequential circuits
- To discuss the concept of memories and programmable logic devices.

UNIT I NUMBER SYSTEM, BOOLEAN LOGIC AND MINIMIZATION TECHNIQUES 15

Introduction to Number systems- Binary, Octal, Hexadecimal, BCD, Grey code, Excess 3 code - Binary Arithmetic, 1's complements, 2's complements, and Code conversions. Boolean theorems, Boolean algebra – AND, OR, NOT, NAND AND NOR operation. Minimization – K- Map, Don't care conditions - Five Variable K maps, Tabular Minimization Procedures.

UNIT II COMBINATIONAL CIRCUITS 15

Half and Full Adders - Half and Full Subtractors - Code Converters- Encoder – Decoder - Multiplexer-Demultiplexer -Binary/ BCD adders, Subtractors - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS 15

General model of sequential circuits – Latch, Flip Flops– SR, D, JK and T, Level triggering, Edge triggering, Master slave configuration. Realization of one flip flop using other flip flop. counters - Binary counters, Modulo–n counter- Ring counter, Johnson counter**.**

UNIT IV DESIGN OF SEQUENTIAL CIRCUITS 15

Classification of sequential circuits – Moore and Mealy - Design of Asynchronous counters- state diagram- State table –State minimization –State assignment- Register – shift registers - Universal shift register. Hazards: Static – Dynamic.

UNIT V MEMORY AND PROGRAMMABLE LOGIC DEVICES 15

Memories - ROM, PROM, EPROM, Programmable Array Logic (PAL), Programmable Array Logic (PAL) - Implementation of combinational logic using PROM and PLA, PAL.

TOTAL PERIODS 75

COURSE OUTCOMES

At the end of this course, the students will be able to

- solve the fundamentals of digital logic with various number systems and codes.
- explain the concept of how to designing various combinational and sequential circuits
- elaborate the complex arithmetic and logic circuit and to evaluate its function realization using gates.
- discuss the basics about synchronous and asynchronous circuits
- propose the complex logic memories, programmable logic devices and test its functionality and timing.

TEXT BOOKS

1. Morris Mano M., "Digital Circuits and Logic Design", Prentice Hall of India, II Edition, 1996.
2. Ronald J. Tocci Neal S. Widmer and Gregory L. Moss, Digital Systems: Principles and Applications, Prentice Hall of India, New Delhi, 2010.

3. ZainalabedinNavabhi, VHDL Analysis and Modeling of Digital Systems, McGraw-Hill, 1998.

REFERENCES

1. W.H. Gothmann, "Digital Electronics – Introduction Theory and Practice", PHI, 1992.
2. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 2nd Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2004.
3. W.H. Gothmann, "Digital Electronics – Introduction Theory and Practice", Prentice Hall of India Pvt. Ltd New Delhi, 1992.
4. R.R. Jain, "Modern digital electronics", Third edition, Tata McGraw – Hill, 3rd edition 2003.
5. Leach and Malvino, "Digital Principles of Electronics & Applications", Tata McGraw – Hill, 5th Edition, 2003.

WEB LINKS

1. https://en.wikipedia.org/wiki/Digital_electronics
2. http://www.electrical4u.com/digital-electronics/
3. http://www.asic-world.com/digital/tutorial.html

MT16304 KINEMATICS OF MACHINERY 3 2 0 4

COURSE OBJECTIVES

- To inculcate knowledge about the basics of mechanisms and understand the geometry of motion at any point in a link of a mechanism.
- To examine students to understand the types of cam and follower, motion and profile drawing of cam.
- To construct students on the phenomenon of direction of rotation, speed and torque determination for simple, compound and planetary gear systems.
- To propose the effects of friction in motion transmission and in machine components.
- To the motion resulting from a specified set of linkages in a mechanism.

UNIT I BASICS OF MECHANISMS 15

Introduction to Mechanisms – Degree of Freedom – Kutzbach criterion – Grashoff's law – Kinematic Inversions of Four bar chain, Slider, Double crank chains – Description of common Mechanisms– Single, double and offset slider mechanisms – Quick return mechanisms Ratchets and escapements – Indexing Mechanisms – Design of Crank and Rocker Mechanisms.

UNIT II KINEMATICS OF LINKAGES 15

Displacement, velocity and acceleration and analysis in simple mechanisms – Graphical Method velocity and acceleration polygons – Vector Approach, Computer applications in the kinematic analysis of simple mechanisms – Coriolis Components of Acceleration.

UNIT III KINEMATICS OF CAM 15

Classifications – Displacement diagrams – Parabolic, Simple harmonic, UAAR and Cycloidal motions – Layout of plate cam profiles – Derivatives of Follower motion – High speed cams – circular arc and tangent cams– Pressure angle and undercutting.

UNIT IV GEARS AND GEAR TRAINS 15

Spur gear Terminology and definitions – Fundamental Law of toothed gearing and involute gearing – Inter changeable gears – gear tooth action - Contact ratio – Terminology – Helical, Bevel, Worm, Rack and Pinion Gears (Basics only) – Gear trains – Parallel axis gear trains – Epicyclic gear trains.

UNIT V FRICTION 15

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt and rope drives, Friction aspects in Brakes.

TOTAL PERIODS 75

COURSE OUTCOMES

At the end of this course, the students will be able to

- improve the basics of mechanisms and the geometry of motion at any point in a link of a mechanism.
- construct the profile of cam for any given combination and condition.
- determination the speed and torque for simple, compound and planetary gear systems.
- identify the effects of friction in motion transmission and in machine components.
- prioritize the sliding and rolling friction.

TEXT BOOKS

1. Khurmi, R.S.,"Theory of Machines", 14th Edition, S Chand Publications, 2009.
2. Rattan S.S, "Theory of Machines", Tata McGraw – Hill Publishing Company Ltd., New Delhi, 2010.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2001.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East – West Pvt. Ltd., New Delhi, 2005.
3. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley – Eastern Ltd., New Delhi, 2007.
4. John Hannah and Stephens R.C, "Mechanics of Machines", Viva Low – Prices Student Edition, 2008.
5. Shigley J.E and Uicker J.J, "Theory of Machines and Mechanisms", McGraw – Hill, Inc.2008

WEB LINKS

1. www.asic-world.com/digital/tutorial.html
2. https://www.britannica.com/science/friction

EE16305 **ELECTRICAL MACHINES AND DRIVES (COMMON TO MECH & MCT)** **3 0 0 3**

COURSE OBJECTIVES

- To impart students with fundamentals of energy conversion, construction and principle of operation.
- To facilitate students to understand the characterization of electrical machines and various drives.
- To give awareness to concept of starting methods and speed control of electrical machines.
- To analyse the operation of solid state speed control of DC. drives.
- To understand the solid state speed control of AC. drives.

UNIT I DC MACHINES **9**

DC Generator-Construction and Principle of operation, EMF Equation, types, OCC and External characteristics cures. DC Motors-Principle of operation, types, Characteristics – Starters - Braking methods

UNIT II AC MACHINES **9**

AC Generator-Construction and working principle - Three Phase Induction motors, Construction, types, principle of operation, characteristics and starting methods, Single phase induction motor- Construction and working principle of operation.

UNIT III FUNDAMENTALS OF ELECTRIC DRIVES **9**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – loading conditions and classes of duty – Selection of power rating for drive motors - Load variation factors.

UNIT IV CONVENTIONAL AND SOLID STATE CONTROL OF DC DRIVES **9**

Speed control of DC series and shunt motors – Armature and field control, Ward- Leonard control system – Solid state control using controlled rectifiers (Single phase Half & Full wave) and DC choppers –applications.

UNIT V CONVENTIONAL AND SOLID STATE CONTROL OF AC DRIVES **9**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverters and AC voltage regulators – applications.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- select and utilize various dc machines.
- employ effective control techniques to electrical motors.
- demonstrate the concept applied in electric drives.
- apply solid state speed control of D.C. drives.
- select appropriate electrical drive for engineering applications.

TEXT BOOKS

1. Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2004.
2. VedamSubrahmaniam, “Electric Drives (concepts and applications)”, Tata McGraw- Hill, 2001.
3. Pillai S.K., “A First course on Electrical Drives”, New Age International Publishers, 2011.

REFERENCES

1. Theraja B.L and Theraja A.K., “A Text book of Electrical Technology”, Volume – II, S,Chand& Co., 2007.
2. M.D.Singh, K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 1998
3. R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., 2003.
4. Bimal K Bose, “Modern Power Electronics and AC Drives”, Prentice-Hall of India Pvt. Ltd., 2003.
5. Muhammad H. Rashid, “Power Electronics: Circuits, Devices and Applications”, Pearson Education, 2004.

WEB LINKS

1. https://en.wikipedia.org/wiki/DC_motor
2. https://en.wikipedia.org/wiki/AC_motor
3. http://www.electrical4u.com/control-of-electrical-drives/

MT16305 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To design the understanding of the fundamentals of fluid mechanics and hydraulic machines
- To improve the classical experimental and diagnostic techniques, and the principles behind these techniques
- To invent the practice in making engineering judgments, estimates and assessing the reliability of the
- measurements and skills which are very important in all engineering disciplines
- To understand and practise standard measurement techniques of fluid mechanics and their applications
- To predicted the fundamentals of fluid mechanics and hydraulic machines

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Study of Bernoulics Theorem apparatus.
4. Study of Losses in Pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump.
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear oil pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- list the fundamentals of fluid mechanics and hydraulic machines.
- apply experimental knowledge on classical, experimental and diagnostic techniques.
- estimate and assess the reliability of measurements which are very important in all engineering disciplines.
- test venturimeter and orifice meter to determine the fluid flow parameters.
- discuss the experiments to assess the performances of various hydraulic machines.

REFERENCES

1. P. N. Modi and S. M. Seth, “Hydraulics and Fluid Mechanics”, Standard Book House, Delhi, (1991).
2. S. S. Rattan, “A Text Book of Fluid Mechanics”, Khanna Publishers, Delhi, (1994)
3. Som, S.K. and Biswas, G., “Introduction to Fluid Mechanics and Fluid Machines”, Second Edition, Tata McGraw-Hill, New Delhi, 2nd Edition, (2007).

MT16306 COMPUTER AIDED MACHINE DRAWING 0 0 2 1

COURSE OBJECTIVES

- To design the specifications and symbols of standard machine components used in machine drawing.
- To formulate the concept of various tolerances and fits used for component design.
- To recommended and practice the drawing of machine components and simple assemblies using standard CAD packages.
- To improve and create drawings manually or using any one CAD packages for standard machine components and assemblies with tolerance.

LIST OF EXPERIMENTS

1. Introduction to Machine Drawing - Dimensioning, Sectional views, Welding symbols, surface finish Symbols.
2. Study of Limits, Fits and tolerances.
3. Free hand sketching of Machine Elements - Keys, Hexagonal and Square Head Bolts and Nuts, Conventional representation of Threads.
4. Converting given isometric view into orthographic views
5. Part and Assemble drawing of Universal coupling and Flange Coupling
6. Part and Assemble drawing of Bearings.
7. Part and Assemble drawing of Valves.
8. Part and Assemble drawing of Machine Elements – Tail Stock, Screw Jack and Connecting Rod Assembly.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- decide the dimensioning, sectional views, welding symbols.
- construct the various part and assemble drawing of bearings .
- exmine the various part and assemble drawing of couplings.
- predict the various part and assemble drawing of valves.
- state the part and assemble drawing of machine elements – tail stock, screw jack and connecting rod assembly.

EE16306 **ELECTRICAL ENGINEERING LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

- To make the students conduct various experiments on D.C. machines and transformers and analyze their performance for practical exposure.
- To conduct relevant experiments for determining the performance characteristics of AC machines.

LIST OF EXPERIMENTS

1. Load test on DC shunt motor.
2. Load test on DC Series motor
3. Open circuit and load characteristics of DC generator.
4. Speed Control of DC Shunt Motor (Armature and Field control)
5. Swinburne's test.
6. Load test on three phase alternator.
7. Load test on three phase squirrel cage induction motor.
8. Speed control of three phase squirrel cage induction motor.
9. Load test on single phase induction motor.
10. Study of DC and AC Starters.

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, students will be able to

- examine the characteristics of DC motors under loaded and unloaded conditions.
- demonstrate the various starting methods in AC motors.
- employ practically the speed control in DC shunt motor.
- analyse the performance characteristics of AC motors practically.

EN16301 BUSINESS ENGLISH COURSE LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To develop the reading skills of the students and make them familiarized in skimming and scanning.
- To instil the communication concepts to enhance the students' conversational skills through various practice sessions and to familiarize them with a variety of business correspondence.
- To inculcate the receptive skills i.e. listening and reading and to make the students well versed in the productive skills and to assist them in improving their vocabulary and comprehension of grammar.
- To expose the students to listening and speaking skills.

UNIT I READING AND VOCABULARY 6

Understanding short, real notices, messages - detailed comprehension of factual material- skimming and scanning skills - interpreting visual information - reading for detailed factual information - reading for gist and specific information - reading for grammatical accuracy and understanding of text structure - reading and information Transfer.

UNIT II WRITING 9

Re-arranging appointments - asking for permission - giving instructions - apologizing and offering compensation - Making or altering reservations - dealing with requests - giving information about a product.

UNIT III LISTENING 6

Listening to short telephonic conversation - Listening to short conversation or monologue - Listening to specific Information - Listening to conversation- interview, discussion.

UNIT IV SPEAKING 9

Conversation between the interlocutor and the candidate - general interaction and social language - A mini presentation by each candidate on a business theme - organizing a larger unit of discourse - giving information and expressing opinions - two-way conversation between candidates followed by further prompting from the interlocutor- Expressing opinions- agreeing and disagreeing

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- enrich the vocabulary through reading and can develop their pronunciation skills.
- speak effectively in English on all occasions.
- prepare flawless reports and proposals.

TEXT BOOKS

1. Cambridge BEC Preliminary, Self-Study Edition, Cambridge University Press, New York, 2012.
2. Whitby, Norman. Business Benchmark, Pre-intermediate to intermediate, Business Preliminary, Shree Maitrey Printech Pvt. Ltd., Noida, 2014.

REFERENCES

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice.
2. Oxford University Press, New Delhi. 2011.

3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001

WEB LINKS

1. http://www.cambridge.org/us/cambridgeenglish/catalog/cambridge-english-exams-ielts/business-benchmark
2. www.skillsyouneed.com/ips/active-listening.htm

SEMESTER IV

MA16404 **NUMERICAL METHODS** **3 2 0 4**

(COMMON TO AERO,CIVIL,EEE,MECH & MCT)

COURSE OBJECTIVES

- To analyse different methods to find solution for a large system of linear equations
- To find the intermediate values for a series of given data
- To develop efficient algorithms for solving problems in science, engineering and technology
- To solve the non linear differential equations that cannot be solved by regular conventional method.
- To apply finite element method to increase the accuracy of second order differential equations

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 15

Solution of equation –Iteration method : Newton Raphson method – Solution of linear system by Gaussianelimination and Gauss - Jordon method – Iterative method – Gauss-Seidel method – Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION 15

Lagrangian Polynomials – Divided differences – Newton's Divided Difference, Hermite Interpolation Polynomial and Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 15

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3– Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons' rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 15

Single step methods: Taylor series method – Modified Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 15

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL PERIODS 75

COURSE OUTCOMES

At the end of this course, the students will be able to

- comprehend the basics of linear equations.
- apply the interpolation methods for constructing approximate polynomials
- demonstrate the knowledge of numerical differential equations in computational and simulation process
- utilize the concept of initial value problems in the field of science and engineering
- describe the computational procedure of the amount of heat emitted or transferred from an object

TEXT BOOKS

1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2nd ed., Tata McGraw-Hill, 2006.
3. Sankar Rao K " Numerical Methods For Scientisits And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003
2. Gerald C.F. and Wheatley, P.O., "Applied Numerical Analysis" 6th Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyangar , R.K.Jain , "Numerical Methods For Scientific & Engineering Computation" New Age International (P) Ltd , New Delhi , 2005.
4. M.B.K. Moorthy and P.Geetha, "Numerical Methods" , Tata McGraw Hill Publications company, New Delhi, 2011.

WEB LINKS

1. https://www.youtube.com/watch?v=QTQ8bO1F-Dg
2. https://www.youtube.com/watch?v=AT7Olelic8U
3. https://www.youtube.com/watch?v=TH06N7Q7FJw
4. https://www.youtube.com/watch?v=DnBJLpdVHCY
5. https://www.youtube.com/watch?v=5TccPEz2nB8

MT16401 DYNAMICS OF MACHINERY 3 2 0 4

COURSE OBJECTIVES

- To invent the knowledge about the static and dynamic force analysis on various parts of reciprocating engine, the function of flywheel and to construct the various turning moment diagram.
- To propose the knowledge about balancing of various parts for different engine.
- To predict the causes of free vibration through analysis.
- To elaborate the analysis and causes of forced vibration.
- To advertise the effects of vibration in various beams under different load conditions and the basic concepts of governor and gyroscopes.

UNIT I FORCE ANALYSIS 15

Rigid Body dynamics in general plane motion – Equations of motion- Dynamic force analysis – Inertia force and Inertia torque – D. Alembert's principle – The principle of superposition –Dynamic Analysis in Reciprocating Engines – Turning moment diagrams – Fly wheels.

UNIT II BALANCING 15

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder Engine Balancing Multi – Cylinder Engines – Partial balancing in locomotive Engines – Balancing linkages.

UNIT III FREE VIBRATION 15

Basic features of vibratory systems – Degrees of freedom – Free vibration – Equations of motion – Types of Damping – Damped vibration critical speeds of simple shaft – Torsional systems; Natural frequency of two and three rotor systems

UNIT IV FORCED VIBRATION 15

Response to periodic forcing – Harmonic Forcing – Forcing caused by unbalance – Support motion – Force Transmissibility and amplitude transmissibility vibration isolation.

UNIT V MECHANISM FOR CONTROL 15

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Controlling Force - Other governor mechanisms. Gyroscope – Gyroscopic couple – Gyroscopic Stabilization - Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL PERIODS 75

COURSE OUTCOMES

At the end of this course, the students will be able to

- formulate static and dynamic force analysis on various parts of reciprocating engine and construct turning moment diagram of flywheel.
- judge the balancing of various parts for different engine.
- improve knowledge on analysis of free vibration.
- improve knowledge on analyze of forced vibration.
- design the basic concepts of Mechanism for Control of Centrifugal governors and gyroscopes.

TEXT BOOKS

1. Khurmi, R.S., “Theory of Machines”,14th Edition, S Chand Publications, 2009.
2. Rattan. S. S, “Theory of Machines”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2011.

REFERENCES

1. Thomas Bevan, “Theory of Machines”, CBS Publishers and distributors, 2010.
2. Ghosh A. and Mallick A.K., “Theory of Mechanisms and Machines”, Affiliated East- West Press Pvt. Ltd., New Delhi, 2010.
3. Shigley J.E. and Uicker J.J., “Theory of Machines and Mechanisms “, McGraw – Hill, Inc., 2009.
4. Rao J.S. and Dukkipati R.V., “Mechanism of Machine Theory”, Wiley – Eastern Limited, New Delhi, 2008.
5. John Hannah and Stephens R.C., “Mechanics of Machines”, Viva low – Priced Student Edition, 2007.

WEB LINKS

1. http://nptel.ac.in/courses/112104114/
2. http://freevideolectures.com/Course/2364/Dynamics-of-Machines

MT16402 CONTROL SYSTEMS ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To describe the feedback control and basic components of control systems.
- To identify the various time domain and frequency domain tools for analysis and design of linear control systems.
- To discuss the methods to analyze the stability of systems using root locus technique.
- To describe the methods of designing compensators and applications of control systems.
- To compute knowledge in the basic concepts of linear control theory and design of Control system.

UNIT I BASIC CONCEPTS AND SYSTEM REPRESENTATION 9

Basic elements in control systems – Open and closed loop systems with example –Mathematical model of Translational, Rotational & Electrical systems – Transfer function – Block diagram reduction techniques – Signal flow graph.

UNIT II TIME RESPONSE ANALYSIS 9

Introduction – Time domain specifications – Types of test inputs I and II order system response– Steady state error – Error coefficients – Generalized error series – P, PI, PD, PID Controlled characteristics.

UNIT III FREQUENCY RESPONSE ANALYSIS AND DESIGN 9

Introduction – Frequency domain specifications – Bode plots and polar plots – Constant M and N circles and Nichols chart – Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY OF CONTROL SYSTEMS 9

Characteristics equation – Location of roots in s-plane for stability – Routh Hurwitz criterion –Root locus Construction – Gain margin and phase margin – Nyquist stability criterion.

UNIT V COMPENSATION DESGIN & APPLICATIONS OF CONTROLSYSTEMS 9

Realization of basis compensation – Lag, Lead and Lag – lead networks – Compensator design using Bode plots. Stepper motors- AC & DC Servo Motor-Hydraulic Controller-Pneumatic Controller - Overview of Distributed Control system and PLC.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- construct the feedback control and basic components of control systems.
- explain the various time domain and frequency domain tools to analysis and design of linear control systems.
- conduct the analysis to stability of systems from transfer function and to define the methods of designing compensators.
- identify the application areas of control system.
- discover the compensation design processes.

TEXT BOOKS

1. J. Nagrath and M. Gopal, *Control System Engineering*, New Age International Publisher, New Delhi, 2011.

REFERENCES

1. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition, Pearson Education 2003.
2. I.J.Nagrath& M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
3. B.C.Kuo, "Automatic control systems", Prentice Hall of India ltd, New Delhi 1995.
4. Dorf R.C. and Bishop R.H., "Modern Control systems", Addison – Wesley, 1995 (MATLAB reference).
5. Leonard N.E. and William Levine, "Using MATLAB to Analyze and Design Control Systems,"

WEB LINKS

1. http://nptel.ac.in/courses/108101037/1
2. https://en.wikipedia.org/wiki/Control_engineering

MT16403 **MECHANICS OF SOLIDS** **3 2 0 4**

COURSE OBJECTIVES

- To construct the theoretical basis about the stress, strain and elastic modulus.
- To identify the concepts in various components with sound mathematical principles and to systematically solve engineering problems regardless of difficulty.
- To calculate the shear force, bending moment, deflection and slopes in various types of beams with different load conditions.
- To identify the concept of confidence and competence while solving problems related to the machine components like shafts, columns, springs and purposes.
- To explain the basic concept in torsion in shafts and springs.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 15

Properties of mild steel, cast iron, aluminum alloys, copper alloys and magnesium alloys - Mechanical properties of Materials - Stress and Strain - Stresses and strains due to axial force - Hooke's law - Factor of safety -Poisson's ratio - Elastic constants and their relationship Stress-Strain Curve for Ductile and Brittle Materials.

UNIT II ANALYSIS OF STRESSES IN TWO DIMENSIONS 15

State of stresses at a point - Normal and tangential stresses on inclined planes - Principal planes and stresses – Plane of maximum shear stress - Mohr's circle for biaxial stresses. Behavior of thick wall pressure vessels

UNIT III BEAMS 15

Types of beams: Supports and Loads - Theory of simple bending - Stresses in beams: bending and shear stress - Stress variation along the length and section of the beam, Slope and Deflection of beams: Double integration for Cantilever and simply supported beams Section modulus

UNIT IV COLUMNS 15

Columns - Buckling of long columns due to axial load - Equivalent length of a column - Euler's and Rankine's formulae for columns of different end conditions Deflection in overhanging beams

UNIT V SHAFTS 15

Analysis of torsion of circular bars - Shear stress distribution - Bars of Solid and hollow circular section – Compound shafts.

TOTAL PERIODS 75

COURSE OUTCOMES

At the end of this course, the students will be able to

- examine the stress, strain and elastic moduli under given loading.
- construct the shear force and bending moment diagrams of standard beams.
- show the deflection and slopes in various types of beams with different load conditions.
- solve the problems related to the machine components like shafts, columns, springs and purposes.
- identify the application areas of springs.

TEXT BOOKS

1. R. K. Bansal, A text book of Strength of Materials, Laxmi Publications (P) Limited, New Delhi, 2010.
2. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning. Ltd., New Delhi, 2010.

REFERENCES

1. R.K.Rajput, Engineering Materials, S. Chand and Company Ltd, New Delhi, 2007.
2. P. Purushothama Raj and V. Ramasamy, Strength of Materials, Pearson Education, India, 2013.
3. S. Rattan, Strength of Materials, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2011.
4. B. K. Sarkar, Strength of Materials, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
5. Irring H. Shames and James M. Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India Learning. Ltd., New Delhi, 2009.
6. R. Subramaniam, Strength of Materials, Oxford University Press, New Delhi 2012.

WEB LINKS

1. www.engineersedge.com/strength_of_materials.html
2. www.me.mtu.edu/~mavable/MoM2nd.html

MT16404 **PRODUCTION TECHNOLOGY** **3 0 0 3**

COURSE OBJECTIVES

- To identify the basics and working principle of various manufacturing processes.
- To distinguish conventional and non-conventional machining processes.

UNIT I FOUNDRY TECHNOLOGY **9**

Pattern and Core making: Pattern types, allowances, types of cores, core print - Moulding sand: types,properties, green sand moulding - Melting furnaces: Induction furnaces, CO2 process, Centrifugal Castings,Shell Casing, Investment Casting, Die casting, Defects in casting.

UNIT II FORMING – PROCESSES **9**

Hot Working and Cold Working. Rolling: Introduction – Rolling Mills – Rolling Operations – Production of Seamless Tubing and Pipe. Forging: Introduction – Related Forging Operations – Drop forging. Extrusion and Drawing: Extrusion Practice – Hot, Cold, Impact and Hydrostatic extrusion. Sheet metal operations – Blanking, Punching and Piercing.

UNIT III MATERIAL REMOVAL PROCESSES **9**

Lathes and Lathe Operations, Drilling and Drilling Machines, Reaming and Reamers, Tapping and Taps- Tool nomenclature, cutting speed, feed, machining Time calculations.

UNIT IV SPECIAL MACHINES **9**

Milling Machines and Operations, Planning and Shaping, Broaching, Gear Hobbing and Shaping. Grinding Process – Abrasives – Finishing operations –lapping, Honing Powder coating.

UNIT V PRINCIPLES AND APPLICATIONS OF JOINING PROCESSES **9**

Gas welding, Basic Arc Welding Processes, Thermit Welding, Electron – Beam Welding, Laser– Beam Welding, Ultrasonic Welding, Friction Welding, Electro slag, Resistance welding, Principles and application of Brazing and Soldering.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- identify the basics and working principle of various casting processes.
- improve the knowledge on forming processes.
- explain the basic and working principle of conventional machining process.
- construct the basic and working principle of special machines.
- identify the basic application and principles of metal joining process.

TEXT BOOKS

1. Kalpakjian, S., “Manufacturing Engineering and Technology”, Pearson education India,4th edition, 2001(ISBN 81 78081 571)
2. ZainalabedinNavabhi, VHDL Analysis and Modeling of Digital Systems, McGraw-Hill, 1998. 2009.

REFERENCES

1. Hajra Choudhury, S.K., and Haqjra Choudhury, A.K., “Elements of Workshop Technology”, Volume I & II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
2. Paul Degarma E, Black J.T. and Ronald A. Kosher, eighth edition, Materials and Processes in Manufacturing Prentice – Hall of India, 1997.
3. Sharma P.C. A Textbook of Production Technology, S. Chand and Co., Ltd., 1999.

WEB LINKS

1. 1. https://books.google.com/books?id=sT6jwN1LKTQC&printsec=frontcover&dq=Manufacturing+Technology&hl=en&sa=X&ei=NWUaVZfkNMyyogSG9YCACA&ved=0CDgQ6AEwAw#v=onepage&q=Manufacturing%20Technology&f=false
2. https://www.google.com/search?tbm=bks&hl=en&q=Manufacturing+Technology

EE16410 MICROPROCESSORS AND ITS APPLICATIONS 3 0 0 3

COURSE OBJECTIVES

- To study the architecture of 8085.
- To understand the addressing modes and instruction set of 8085.
- To impart knowledge of commonly used peripheral devices.
- To gain the knowledge of interrupt controller / interfacing ICs.
- To cognizant the applications of microprocessor.

UNIT I INTRODUCTION 9

Organization of Micro Computers – Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes – instruction and machine cycles with states and timing diagram.

UNIT II MEMORY AND I/O DEVICES 9

Need for Interfacing – Memory Interfacing: address space partitioning – address map – Address decoding –Bus contention. I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts.DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 systems – serial data transfer.

UNIT III INTERFACING DEVICES 9

Programmable peripheral device – programmable interval timer (8253) – Programmable communication interface (USART) – Programmable interrupt controller – Programmable DMA Controller (8257), programmable peripheral interface (8255).

UNIT IV DESIGN USING PERIPHERAL DEVICES 9

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 using 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 -Design of Keyboard and display interfacing using 8279.

UNIT V MICROPROCESSOR APPLICATIONS 9

Temperature monitoring system – Automotive applications – Closed loop process control –Stepper motor control.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students will be able to

- understand the architecture of 8085, instruction set and addressing modes of 8085 and illustrate with simple programs.
- get knowledge about commonly used peripheral / interfacing ics.
- analyse the concepts of i/o interfacing, execution.
- design microprocessor based systems using peripheral devices.
- device selection and the applications of microprocessor.

TEXT BOOKS

1. Ramesh Goankar, “Microprocessor Architecture, Programming and Applications with 8085”,
2. Umashankar B.S., Udaya Kumar K, “The 8085 Microprocessor: Architecture, Programming and Interfacing”, Publisher: Pearson Education, 2008.
3. R.Theagarajan, S.Dhanasekaran, S.Dhanapal, “Microprocessors and its applications”, New Age International, 2004

REFERENCES

1. V. Douglas Hall, “Microprocessors and Interfacing Programming and Hardware”, Tata McGraw - HillPublishing Company Ltd., 2002.
2. K. Ray and K. M. Bhurchandi, “Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing”, Tata McGraw - Hill Publishing Company Ltd., 2006.
3. Aditya P. Mathur, “Introduction to Microprocessor”, Tata McGraw-Hill Publishing Company Ltd., 2003.
4. Rafiquzzaman M., “Microprocessors Theory and Applications: Intel and Motorola”, Prentice Hall, 2003.
5. Krishnakant “Microprocessors and Microcontrollers Architecture Programming and System Design”, 8085- 8086- 8051- 8096”, PHI, 2007.

WEB LINKS

1. https://en.wikipedia.org/wiki/Microcontroller
2. http://www.zseries.in/embedded%20lab/8085%20microprocessor/other%20applications.
3. http://www.zseries.in/embedded%20lab/8085%20microprocessor/other%20applications.
4. http://www.nptel.ac.in/courses/Webcourse-

EE16411 **MICROPROCESSOR LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

- To able to write program using arithmetic operations of microprocessors.
- To understand various IC interfacing with 8085.
- To experimentally understand the operation of Intel 8085 microprocessor.
- To know about the Sorting of number series and Code conversion.
- To learn the Arithmetic and geometrical series, A/D and D/A conversions.

LIST OF EXPERIMENTS

I. Programming

1. Addition and subtraction of two 8 bit numbers.
2. Addition and subtraction of two 16 bit numbers.
3. Decimal addition and subtraction of two 8 bit numbers
4. To arrange a series of numbers in ascending order.
5. To arrange a series of numbers in descending order
6. To find the largest and smallest number in given array.
7. Multiplication and Division of 8 bit numbers
8. Decimal to hexadecimal conversion and hexadecimal number to decimal number conversion.

II. Interfacing

1. Analog to digital conversion.
2. Digital to analog conversion.
3. Stepper motor controller.
4. Temperature controller.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- write the assembly level of programming in 8085 microprocessors.
- interfacing stepper motor, ADC, DAC and temperature controller with 8085 microprocessors.

MT16405 PRODUCTION TECHNOLOGY LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To improve the knowledge and skill in the field of conventional machine tools used in the industries.
- To examine the practical knowledge on machining processes.

LIST OF EXPERIMENTS

UNIT I LATHE PRACTICE

a. Step Turning
b. Taper Turning
c. Thread Cutting

UNIT II DRILLING PRACTICE

a. Drilling
b. Tapping
c. Reaming

UNIT III MILLING PRACTICE

a. Surface Milling
b. Gear Cutting
c. Contour Milling

UNIT IV SHAPING PRACTICE

a. Cutting Key Ways
b. V-Block machining
c. Round to Square shape

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- operate the lathe and make parts by performing step turning, taper turning and thread cutting operations.
- perform the drilling, tapping and reaming.
- ability to operate milling make parts by performing milling and cutting process.
- imagine the shaping and machining process.

REFERENCES

1. Central Machine Tool Institute (CMTI), Machine Tool Design Handbook, Tata McGraw-Hill Publishing Company Ltd, Bangalore, 2008
2. GeofferyBoothroyd and Winston A. Knight, Fundamental of Machining and Machine Tools, CRC Press, Taylor and Francis Group, Indian Edition, 2006
3. Heinrich Gerling and Karl H. Heller, All About Machine Tools, New Age International (P) LimitedPublishers, Noida, 2008
4. Steve F. Krar, Arthur R. Gill and Peter Smid, Technology of Machine Tools, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008

MT16406 MACHINE DYNAMICS LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To list the various practical aspects of instrumentation with emphasis on mechanical domain.
- To explain the various types of governor, cam, balancing of rotating masses and to determine the M.I. of various systems.
- To discuss the concept of mechanical measurement and various methods used for measuring the
- To identify about the single and multi-degree freedom suspension systems.
- To formulate the concept of vibrating system spring mass.

LIST OF EXPERIMENTS

1. Governor – Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell Governors.
2. Cam – Study of jump phenomenon and drawing profile of the cam.
3. Motorized Gyroscope – Verification of law's – Determination of gyroscopic couple.
4. Whirling of shaft – Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system spring mass – system – Determination of damping co – efficient of single degree of Freedom system.
9. Determination of influence co – efficient for multi degree freedom suspension system.
10. Determination of transmissibility ratio – vibrating table.
11. Determination of torsional natural frequency of single and Double Rotor systems. - Undamped and Damped Natural frequencies.
12. Transverse vibration of Free and Fixed beam with and without concentrated masses.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- relate the different characteristics of governors and verify with gyroscopic relation.
- draw the cam profile with different followers and study of jump phenomenon.
- identify the system response, natural frequency and resonance for free, forced, torsional.
- know experimental verification of dynamic balancing of rotating masses, reciprocating masses.
- analyze and present the findings of experimental observations in both written and oral way.

MT16407 **MINI PROJECT** **0 0 2 1**

COURSE OBJECTIVES

- To improve the skills to formulate a technical project.
- To explain the various tasks of the project and standard procedures.
- To Teach the use of new tools, algorithms and techniques required to carry out the projects.
- To analyze the various procedures for validation of the product and analyze the cost effectiveness
- To examine the technical report of the project.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The Device/system/component to Be fabricated may be decided in consultation with the supervisor. A project report to be submitted by the group and the fabricated model, which will be reviewed and Evaluated for internal assessment by a Committee Constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the Project report jointly by external and internal examiners constituted by the Head of the Department. It is highly desirable to publish their project in state/ national level conferences or Symposiums.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- formulate the real world problem, identify the requirement and develop the design solutions.
- identify the technical ideas, strategies and methodologies.
- use the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- analyze and validate through conformance of the developed prototype and analysis the cost effectiveness.
- explain the acquired knowledge through preparation of report and oral presentations.