SCHEME & SYLLABI

OF

M.TECH
MECHANICAL ENGINEERING

w.e.f. 2018 -2019
(as per AICTE model scheme)

DEPARTMENT OF MECHANICAL ENGINEERING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

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M.TECH (MECHANICAL ENGINEERING)

Curriculum Structure – Semester-wise

First Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MME-101A	Micro Machining Processes	3-0-0	3	25	75	Core-I
MME-102A	CAD/CAM ***(Common with M.Tech-Manufacturing Technology & Automation, Manufacturing & Automation)***	3-0-0	3	25	75	Core-II
MME-103A	Discipline specific Elective-I	3-0-0	3	25	75	Programme Elective-I
MME-104A	Discipline specific Elective-II	3-0-0	3	25	75	Programme Elective-II
MME-105A	Mechanical Engineering Lab-I	0-0-4	2	15	35	Core
MME-106A	Mechanical Engineering Lab-II	0-0-4	2	15	35	Core
RMI-101	Research Methodology and IPR	2-0-0	2	25	75	Core
AUD	Audit Course - 1	2-0-0	0	-	-	Audit
	Total	**16-0-8**	**18**	**155**	**445**	

Discipline specific Elective-I

MME-103A-1	Welding & Allied Process ***(Common with M.Tech-Manufacturing Technology & Automation, Manufacturing & Automation)***
MME-103A-2	Mechatronics and Product Design ***(Common with M.Tech-Manufacturing & Automation)***
MME-103A-3	Design Planning & Control of Production Systems ***(Common with M.Tech-Manufacturing Technology & Automation, Manufacturing & Automation)***

Discipline specific Elective-II

MME-104A-1	IC Engine Combustion & Pollution
MME-104A-2	Numerical Methods & Computing ***(Common with M.Tech-Manufacturing & Automation)***
MME-104A-3	Quality Management ***(Common with M.Tech- Manufacturing & Automation)***

Audit course 1 & 2

AUD-01A	English for Research Paper Writing
AUD-02A	Disaster Management
AUD-03A	Sanskrit for Technical Knowledge
AUD-04A	Value Education
AUD-05A	Constitution of India
AUD-06A	Pedagogy Studies
AUD-07A	Stress Management by Yoga
AUD-08A	Personality Development through Life Enlightenment Skills

Second Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MME-201A	Machine Tool Design	3-0-0	3	25	75	Core-III
MME-202A	Tribology & Maintenance Engineering	3-0-0	3	25	75	Core-IV
MME-203A	Discipline specific Elective-III	3-0-0	3	25	75	Programme Elective-III
MME-204A	Discipline specific Elective-IV	3-0-0	3	25	75	Programme Elective-IV
MME-205A	Mechanical Engineering Lab-III	0-0-4	2	15	35	Core
MME-206A	Mechanical Engineering Lab-IV	0-0-4	2	15	35	Core
AUD	Audit Course – 2	2-0-0	0	-	-	Audit
MME-207A	Mini-Project	0-0-4	2	25	75	Core
	Total	**14-0-12**	**18**	**155**	**445**	

Discipline specific Elective-III

MME-203A-1	Principles of metal casting ***(Common with M.Tech-Manufacturing & Automation)***
MME-203A-2	Jigs & Fixture
MME-203A-3	Computational Fluid Dynamics

Discipline specific Elective-IV

MME-204A-1	Modeling & Simulation
MME-204A-2	Industrial Inspection ***(Common with M.Tech-Manufacturing Technology & Automation, Manufacturing & Automation)***
MME-204A-3	Robotics & Automation
MME-204A-4	Quality Control Techniques ***(Common with M.Tech-Manufacturing Technology & Automation, Manufacturing & Automation)***

Third Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MME-201A	Discipline specific Elective-V	3-0-0	3	25	75	Programme Elective-V
OEC	Open Elective	3-0-0	3	25	75	Open Elective
MME-202A	Dissertation Phase – I	0-0-20	10	50	150	Dissertation
	Total	**6-0-20**	**16**	**100**	**300**	

Discipline specific Elective-V

MME-301A-1	Tool & Die Design
MME-301A-2	Method Engineering & Ergonomics
MME-301A-3	Computer Integrated Manufacturing ***(Common with M.Tech-Manufacturing & Automation)***

Open Elective

OEC-101A	Business Analytics
OEC-102A	Industrial Safety
OEC-103A	Operations Research
OEC-104A	Cost Management of Engineering Projects
OEC-105A	Composite Materials
OEC-106A	Waste to Energy

Fourth Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MME-202A	Dissertation Phase – II	0-0-32	16	125	375	Dissertation
	Total	**0-0-32**	**16**	**125**	**375**	

Total Credits for the programme = 18 + 18 +16 +16 = **68**

Semester I

MME-101A Micro-Machining Processes

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Selection of most apposite machining method is very crucial in precision machining of micro parts. Micro machining has wide applications in the fabrication of micro-electro-mechanical systems (MEMS), micro- fluidics and precision surgical instruments.

Course Outcomes:

At the end of the course, the student shall be able to:

1. To understand the difference between conventional and non- conventional machining
2. To understand the application of new Machining technology,
3. Able to change the process parameter used in non-conventional machining
4. Understand the low cost machining technology used in the industry

Syllabus Contents

Unit-1

Introduction to New Machining Technologies: Micro electromechanical Systems (MEMS), Non-Conventional Machining Process, Comparison of conventional machining processes and new technologies.

Unit-2

Micro-electro-mechanical System Description, System Process, Micro Electromechanical systems paradigms, Materials for MEMS, Future trends: Mechanical Transducers, Optical Transducers, and Multi-Disciplinary Applications.

Unit-3

Ultrasonic machining, Whirling jet machining, fundamental principles, process parameters characteristics, tool design, metal removal rate analysis, important part design, analysis of process, Machining Accuracy and Surface Finish Optimization.

Unit-4

Electro Chemical Machining-Introduction, principles, scheme, process parameters, metal removal rate, Electrochemical grinding: Introduction, tools, process parameters, metal removal rate, Honing, Accuracy and Surface finish Optimization.

Unit-5

EDM- Introduction - basic principles, metal removal rate, machining accuracy and surface finish optimization, selection of tool material and dielectric, analysis of process. Wire electric discharge machining: Principle, Process variables.

Reference Books:

1. Manufacturing Sciences by Ghosh & Malik.
2. Newer machining processes; H.S. Shan
3. Advance machining processes by B. Bhushan
4. Fundamentals of Micro-machining by M.J Madou, CRC Press.

MME-102A CAD/CAM

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Explain principles of various theories of computer aided designing involved along with their industrial applications. Study the design process of any product or operation and how CAD improvises it by increasing the efficiency and accuracy of the process. Study the manual & Computer aided part programming and the various methods for CAPP.

Course Outcomes:

At the end of the course, the student shall be able to:

1. Understand 2-D and 3-D transformations of different object based on coordinate system and design the 2D and 3D surfaces and solids.
2. Understand the various types of curves.
3. Develop a part program using CNC Part Programming.
4. Analyze a part program using APT language.
5. Understand the applications of various CAPP techniques /methods.

Syllabus Contents

Unit-1

Introduction of CAD/CAM, Co-ordinate system in CAD, 2D & 3D Transformation:-Scaling, Rotation, Shearing, Translations & Reflection, introduction of Part family and Group Technology.

Unit-2

Representation of parametric and non-parametric curves, Types of curves (analytic & synthetic curves), Geometric modeling, representation and types of surfaces.

Unit-3

Introduction to FEM and FEA, Basic Concepts of FEM, Meshing, Element Selection, Types of Analysis

Unit-4

Introduction of CAPP & its type (variant, generative and hybrid CAPP), NC part programming, APT programming, advances in CAD/CAM (Agile & Lean manufacturing, concurrent Engineering and reverse engineering)

Unit-5

Fundamentals of Rapid Prototyping, Benefits and Application, STL file Generation, Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling vs. RT, Need for RT. Rapid Prototyping Machines: Classification, Description of RP Machines: Stereo lithography, Selective Laser Sintering, Fused deposition modeling, laminated object manufacturing, Laser powder forming.

Reference Books:

1. CAD/CAM by Groover and Zimmer
2. CAD/CAM Theory and Practice, Ibrahim-Zeid, TATA McGraw Hill
3. CAD/CAM/CIM – P. Radhakrishnan, New age international.
4. Mathematical Elements of Computer graphics- Rogers and Adams
5. Computer Aided Design – Besant and Lui, PHI

MME-103A-1 Welding & Allied Process

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study essential concepts for welding parameters and welding processes. To study various techniques for metal spraying and thermal cutting processes. To study various techniques of welding automation.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand principles of various traditional and newer welding processes
2. Develop concept of welding specific materials such as plastics, stainless steel.
3. Develop concept and techniques of welding automation.
4. Analyze methods of advanced welding processes like underwater welding.
5. Analyze arc welding parameter section and types of metal transfer.
6. Understand concept of thermal spraying and thermal cutting of metals.

Syllabus Contents:

Unit 1:

Introduction: Review of welding processes like gas, arc and resistance welding. Weld bead geometry and shape factors, Weld dilution.

Unit 2:

Welding Power Sources: Types of power sources, External V-I characteristics for constant current and constant voltage power sources, Rectifiers, Solid-state Rectifiers, Inverter systems, Duty cycle.

Unit 3:

Arc Welding Consumables and Metal Transfer: Types of electrodes, AWS and Indian system of classification and coding of covered electrode for mild steel, Shielding gases and associated mixtures. Types of metal transfer, Short circuit/ dip transfer, Free flight, Globular type, Spray type, Forces affecting metal transfer.

Unit 4:

Arc welding processes: Electric arc welding principle, MIG: welding equipment and processes, shielding gas, types of metal transfer. Tungsten inert gas arc welding (GTAW): welding equipment, electrodes, inert gases and torches. Submerged arc welding (SAW): principle of processes, applications, fluxes and welding electrodes used. CO2 welding: Difference from MIG welding, Principle of operation, equipment, welding parameters and applications.

Unit 5:

Other advanced welding processes: Introduction, main features and applications of Ultrasonic welding, Friction welding, Explosive welding and Friction Stir welding, Introduction, methods and applications of Underwater Welding.

Unit 6:

Weldability of specific Materials: Welding of plastics: Difficulties in welding of Plastics, Processes for welding of Plastics. Welding of Stainless Steel, Aluminum and Cast Iron.

Unit 7:

Welding Allied Processes: Surfacing and metal spraying: Surfacing methods such as SMAW, MIG, TIG, SAW. Thermal spraying: Introduction, Procedures, Applications, Advantages and Disadvantages. Thermal cutting of metals: Introduction, types, principle and operation of flame and plasma cutting.

Unit 8:

Automation in Welding: Introduction, Semiautomatic welding, Automatic welding, Welding mechanization, Flexible Automated Welding, Robotic welding, Types of Welding Robots, Robot Selection Mechanics, Joint tracking system.

Reference Books:

1. Modern Welding Technology: by Howard B. Cary and Scott C. Helzer, (Pearson Education)
2. Welding and Welding Technology: by R. Little (TMH)
3. Welding Processes and Technology: by R. S. Parmar (Khanna Publishers)
4. AWS- Welding Handbook.

MME-103A-2 Mechatronics and Product Design

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

The main objective of the course is to formulate mathematical models and to understand solution of various real life problems.

Course Outcomes:

At the end of the course, the student shall be able to:

1. To explore various problems of solution objective
2. To study the design principles of different Mechatronics components and system
3. To define different flip flop
4. To study various models of Engg. Systems.

Syllabus Contents

Unit 1:

Introduction to Mechatronics systems and components, Principles of basic electronics – Digital logic, number system logic gates, Sequence logic flip flop system, JK flip flop, D-flip flop.

Unit 2:

Microprocessors and their applications – Microcomputer computer structure/microcontrollers, Integrated circuits – signal conditioning processes. Various types of amplifiers. Low pass and high pass filters.

Unit 3:

Sensors –sensors and transducers. Displacement, position proximity sensors, velocity, force sensors. Fluid presence Temperature, Liquid level and Llight sensors. Selection of sensors,

Actuators: Pneumatic and hydraulic systems, Mechanical actuation system, Electrical actuation system. Other Electrical/Electronic hardware in Mechatronics system.

Unit 4:

Principles of Electronic system communication, Signal conditioning, Interfacing, A.D. and D.A. convertors, Software and hardware principles and tools to build mechatronic systems, Basic system models, Mathematical models, Mechanical and other system building blocks.

Unit 5:

System models – Engg. Systems, Rotational-translation, Electro- mechanical, Hydraulic-mechanical system, System Transfer functions, First-second order system in series.

Unit 6:

Design and selection of Mechatronics components namely sensors line encoders and resolvers, stepper and servomotors, ball screws, solenoids, line actuators and controllers with application to CNC system. PLC and Ladder programming, Robots, Consumer electronics products, etc. Design of a Mechatronic Products using available software CAD packages MATLAB and SIMULINK.

Reference Books:

1. Mechatronics by W.Bolton, published by Pearson Education, 4th Ed.
2. Automation Production System and CIMS by Mikel P Groover, Prentice Hall of India New Delhi.

MME-103A-3 Design, Planning & Control of Production Systems

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study life cycle approach both for production system and new product development & compare production system with service system. Clarify various MRP models in production planning & sequencing and scheduling of the job on the machines. Understand the utility of forecasting in planning of production system.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Develop life cycle approach to new product development and production system.
2. Develop the concept of break-even analysis, line balancing and relate it with practical industrial work.
3. Understand and generate MRP-I, MRP-II and ERP models for a production system.
4. Estimating production requirement using various forecasting techniques.
5. Analyze the criteria for sequencing & accordingly schedule the job on machines.

Syllabus Contents:

Unit 1:

Introduction to production systems: Aim of production system, generalized model of Production systems, Types and characteristics of production and service systems, Life cycle approach to production management. Case studies of production and service systems.

Unit 2:

Product development and design: Product life cycle, New product development and process selection, stages in new product development, use of decision tree, Breakeven Analysis,

Make/buy decision, Problems for Break-even Analysis Non-linearity in B.E. Analysis, selection of location among alternatives –A case study, systematic layout planning, objectives, types, comparison and application of different types of layouts. Assembly line balancing concept and problems for maximum line efficiency.

Unit 3:

Planning and control for production system: Importance, objectives and types of forecasting methods, Analysis and comparison standard error of estimate, Material Requirement Planning (MRP) objective, dependent demand, inputs to MRP, MRP-II, MRP model, ERP. Element of monitoring and follow up.

Unit 4:

Sequencing and scheduling: Criteria for sequencing, priority sequencing and rules, n job 2 machine, n job 3 machine, n job m machine problems. Scheduling of flow shops and job shops. Gantt chart.

Reference Books:

1. Modern Production / operations management 8th ed. - Buffa, Elwood and Sarin, Rakesh (Wiley)
2. Elements of Production, planning and control - Eilon Samuel (Macmillan)
3. Production control: A quantitative approach - Biegel. J (Prentice Hall)
4. Industrial Engineering and production management – Martand Telsang (S. Chand)
5. Operations Management – Theory and Problems – Joseph Monks (Mcgraw Hill))
6. Production and Operations Management – Kanishka Bedi. (Oxford University Press)
7. Operations Management 2nd ed. – B. Mahadevan. (Pearson)

MME-104A-1 IC Engine Combustion & Pollution

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Make students familiar with the design and operating characteristics of modern internal combustion engines apply analytical techniques to the engineering problems and performance analysis of internal combustion engines , study the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions. To introduce students to the environmental and fuel economy challenges facing the internal combustion engine.

Course Outcomes:

At the end of the course, the student shall be able to:

1. To study different internal combustion engine designs.
2. To recognize and understand reasons for differences among operating characteristics of different engine types and designs.
3. To understand engine design specification, predict performance and fuel economy trends with good accuracy Based on an in-depth analysis of the combustion process.
4. To predict concentrations of primary exhaust pollutants.
5. Exposure to the engineering systems needed to set-up and run engines in controlled laboratory environments.
6. To explore the various pollution process.

Syllabus Contents

Unit 1:

Fuel air Cycles analysis, Thermodynamics of combustion, Chemical equilibrium, Dissociation, Combustion Charts and gas tables for air fuel mixtures and the products of Combustion. Types of

Hydrocarbons in Petroleum fuels, Gasoline grades, required properties of SI and CI engine fuels. Rating of fuels.

Unit 2:

Definition of combustion, combustion modes and flame types, review of property relation, Law of thermodynamics, reactant and product mixtures adiabatic flame temperature, chemical equilibrium and product of combustion. Laminar premixed flame, definition principle characteristics, factors, Influencing flame velocity and thickness, flammability limit sand quenching of laminar flow, ignition, turbulent flames: turbulent flame propagation, flame stabilization.

Unit 3:

Burning of carbon, coal combustion, effect of pollutant emissions from premixed combustion and from non-premixed combustion. Detonation, principle, characteristics one-dimensional, detonation velocity, structure of detonation waves.

Unit 4:

Pollution: Exhaust gases and analysis, orset apparatus , infrared analyzer, determination of air fuel ratios, air pollution and engines.

Text Books:

1. I.C engine Vol. 1 & 2 by Taylor
2. Thermodynamics and Gas Dynamics of IC engines, Vol 1 & 2 by Horlockand Winterbone.

Reference Books:

1. I.C engine Vol 1 & 2 by Benson and Whitehouse.
2. Thermodynamics analysis of combustion engines, by Campbell

MME-104A-2 Numerical Methods & Computing

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems. Apply numerical methods to obtain approximate solutions to mathematical problems. Analyze and evaluate the accuracy of common numerical methods.

Course Outcomes:

At the end of the course, the student shall be able to:

1. To Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. To understand the numerical methods to obtain approximate solutions to mathematical problems.
3. To analyze and evaluate the accuracy of common numerical methods.

Syllabus Contents

Unit 1:

Errors in numerical calculations

Introduction. Numbers and their accuracy. Absolute. Relative and percentage errors and their analysis General error formula.

Interpolation and curve fitting

Taylor series and calculation of functions. Introduction to interpolation . Lagrange approximation .Newton polynomials. Chebyshev polynomials least squares fine. Curve fitting. Interpolation by spline function.

Unit 2:

Numerical differentiation and integration

Approximating the derivative. Numerical differentiation formulas .Introduction to Numerical quadrature. Newton-cores formula. Gausion quadrature.

Solution of nonlinear equations

Bracketing methods for locating error. Initial approximations and convergence criteria. Newton-Raphsen and secant methods .Solution of problems through a structural programming language such as Cor pascal.

Unit 3:

Solution of linear systems

Direct Methods .Gaussian elimination and pivoting Matrix in version. UV factorization Iterative methods for linear problems through a structured programming language such as Cor Pascal.

Eigen value problems

Jacobi. Given's and Householder's methods for symmetric matrices. Rutishauser method for general matrices, power and inverse power methods solution of problems through a structured programming language such as CorPascal.

Unit 4:

Solution of differential equations

Introduction to differential equations. Initial value problems. Euler's methods. Heun's method. Runge Kutta methods .Taylor series method. Predictor-corrector methods. Systems of differential equations. Boundary Valve problems. Finite-difference method. Solution of problems through a Structured programming language such as Cor Pascal.

Partial differential equations

Solution of hyperbolic .Parabolic and elliptic equations .The eigen value problem the power method and the Jacobi's method for eigen value problems. Solution of problems through a structured programming language such as CorPascal.

Text Books:

1. Applied Numerical Analysis by Curtis E. Gerald and Patrick Q. Wheatley- published by Addition Wesley.

2. Applied Numerical Methods- Carnahan. B.H., Luthar. H.A. and Wilkes. J.O. Pub- j. Wiley. New York

Reference Books:

1. Numerical Solution of Differential Equations by M.K. Jain. Published by Wiley Eastern, New York.

2. Introductory Methods of Numerical Analysis by S.D. Sastry. Published by Prentice Hall of India.

3. Numerical Methods- Hornbeek. R.W. Pub- prentice Hall. Englewood Cliffs. N.J.

4. Numerical Methods for Mathematics. Science and Engineering by John H.Mathews. PHI New Delhi.

MME-104A-3 Quality Management

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Quality issues are of increasing importance in an increasing number of business sectors. The development of TQM started in the products industry; it then spread to the private service sectors and is today an issue also in the public sector. Improved quality in products and services is necessary to compete for the customers in a globalized market and it is also a venue to better profitability for most industries and service companies.

Course Outcomes:

1. With this course the students should be able to not only participate in all kind of TQM activates in their own company or institution,
2. To understand the TQM development in selected areas.
3. The course draws heavily on practical cases and the professors own industrial
4. To analyse the theories taught.

Syllabus Contents

Unit 1:

Quality, Chain Reaction, Dimensions of Quality, Evolution of Quality, Quality Control, Quality Assurance, Quality Planning, Quality Improvement, Quality Management, Cost of Quality, Juran's Model of Optimum Quality Costs.

Unit 2:

Total Quality Management Elements of TQM, Leadership for TQM, Demings 14 Points For Top Management, TQM Tools And Techniques, PDSA, Barriers For TQM Implementation.

Unit 3:

Service Quality, Features of Services, Kano Model, Employee Motivation, Motivation Theory of Individual Employees, Effective Communications, Training and Mentoring, Recognition and Reward.

Unit 4:

Statistical Process Control & TQM Tools: Seven Quality Control Tools, Seven Management Tools, Benchmarking, QFD, TPM, FMEA.

Unit 5:

ISO 9000 standard, EMS 14001, Quality Awards.

Unit 6:

Supplier Partnership and Performance Measures: Importance o Suppliers, Selection and Standards, Quality Audit, Product Audit, Vendor Rating System, PDCA for Measurements, Performance Measure Design, BSC.

Reference Books:

1. Total Quality Management by Oakland (Butter worth- HeinamannLtd.)
2. Managing for total quality from Deming to Taguchi and SPC by Logothetis N. (PHI)
3. Total Quality Control by Feigenbaum A.V (MGH)
4. Total Quality Management by Besterfield Dale H (Pearson Education)
5. A slice by slice guide to TQM by John Gilbert (Affiliated East West Press).
6. The TQM tool kit-a guide to practical techniques for TQM by Waller Jenny, Allen Derek and Burna Andrew (Kogan Page)

MME-105A Mechanical Engineering Lab-I

No. of Credits: 2 Sessional: 15 Marks

L T P Total Theory : 35 Marks

0 0 4 4 Total : 50 Marks

Course Objectives:

All major manufacturing companies and their suppliers use CAD software to design parts and evaluate them with respect to fit, form and function. This course introduces students to CAD software in general and SolidWorks 2016 software in particular. Students will learn theory and practice related to solid modeling, assembly modeling, drafting, parametric modeling, free form surface modeling, and use of CAD models for some downstream engineering activities such as motion simulation and manufacturing.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. To Design and drafting of Part Modelling and Assembling Modellings in 2D and 3D models.
2. To Understand the working of CNC Machines, Robots, Machine Vision Design and machine.
3. To Study the Various CAD/CAM packages like Master CAM and Surface
4. To Design and Machining using Master CAM

Syllabus Contents:

1. To create a 2-Dimensional Sketch with the help of all geometrical Shapes.
2. To list the coordinate of given diagram
3. To prepare a part programme for facing & turning operation on a CNC Lathe.
4. Prepare part programme for facing & taper turning operation on CNC Lathe in single cut programming in word address format.
5. To create a solid with all of all solid entities of basic solid modelling commands.
6. Practice Boolean operation on solids.
7. Create surface with help of ruled & the tabulated surfaces.
8. Create a surface with the help of a surface of revolution & edge surface

MME-106A Mechanical Engineering Lab-II

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Theory : 35 Marks
Total : 50 Marks

Course Objectives:

The course should enable the students to understand effect of vehicle population and emitted pollutants on human health and environment and various types of emissions. Understand the formation mechanism of various types of pollutants from SI and CI engines. Conceive the significance of emission control methods.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. To analyze the impact of vehicle population on pollution and the effects HC, CO, CO2, NOX, smoke,
2. To study particulates, lead and aldehydes on health and environment.
3. To describe the effects of transient operation of vehicle on emissions and types of emissions.
4. To describe the formation mechanism of HC, CO, CO2, NOX, smoke, particulates and aldehydes in SI and CI engines.
5. To Study the Comprehend the factors that lead to global warming and the issues. Analyze the design and operating parameters on emissions.
6. To Describe about noise pollution, measurement and control.

Syllabus Contents:

1. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
2. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
3. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
4. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.

5. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp,fhp, vs speed (ii) volumetric efficiency & indicated specific specific fuel consumption vs speed.

6. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method petrol engine.

RMI-101 Research Methodology and IPR

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property. It will create consciousness for Intellectual Property Rights and its constituents. Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understanding and formulation of research problem.
2. Analyze research related information.
3. Understand plagiarism and follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research

problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics.

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Semester II

MME-201A Machine Tool Design

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

The course provides students with fundamental knowledge and principles in material removal processes. To demonstrate the fundamentals of machining processes and machine tools. To develop knowledge and importance of metal cutting parameters. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. To understand cutting mechanics to metal machining based on cutting force and power consumption.
2. To analysis lathe, milling machines, drill press, grinding machines, etc.
3. To develop the cutting tool materials and tool geometries for different metals.
4. To explore the appropriate machining processes and conditions for different metals. Learn machine tool structures and machining economics.
5. To design the various machine tool.

Syllabus Contents:

Unit 1:

Introduction to Machine Tools and Mechanisms: General principles of machine tool design, working and auxiliary motions, machine tool drives hydraulic and mechanical transmission and its elements, general requirements of machine tool design, layout of machine tools. Regulation of

Speed and Feed Rates: Purpose, stepped regulation of speed-design of speed box, machine tool drives using multiple speed motors, developing the gearing diagram, step-less regulation of speed and feed rates.

Unit 2:

Machine Tool Structure: Functions and requirements, design criteria, materials used and their properties, static and dynamic stiffness, cross-sectional shapes used for machine tool structures and basic design procedure for the design of beds, columns and other structural elements, model techniques used in design, introduction to Finite Element Method (FEM).

Unit 3:

Guide ways and Power Screws: Function and types, design considerations & procedure for slide ways, design of power screws.

Unit 4:

Spindles and Spindle Supports: Functions and requirements, materials, effect of machine tool compliance on machining accuracy, design of spindles, bearings design/selection.

Unit 5:

Control Systems: Functions, requirements and classification, control systems for speeds, feeds & auxiliary motions, manual control systems, automatic control systems, adaptive control systems, criteria and economics election of machine tools, future trends in development of machine tools.

Reference Books:

1. Machine tool design By N.K. Mehta
2. Design of Machine Tool By S.K. Basu

MME-202A Tribology & Maintenance Engineering

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Tribology studies combine issues of friction, wear and lubrication into a framework for designing and maintaining the machine world. Until recently, "the design of the shape and material" was being done on the basis of machine dynamics and strength of materials but the predominant part of failure i.e. wear remained neglected.

Course Outcomes:

At the end of the course the students should be able to:

1. Understand the various tribological processes and tribological relevant properties of materials.
2. Study the Various engineering materials having potential for tribological application.
3. Explore the various characterization and evaluation of ferrous materials for tribological requirements/applications.
4. To study the various Selection of ferrous materials for rolling element bearings, gears, crank shafts, piston rings, cylinder liners, etc.
5. Understand the various Non-ferrous materials and their applications such as sliding bearings, piston rings, cylinder liners, etc., materials for dry friction materials.

Syllabus Contents:

Unit 1:

Engineering Tribology: Tribological system, Tribology in industries, friction and wear, lubricants and lubrication, fundamental of bearings, nano Tribology, Introduction part of friction, theories of friction, adhesion theory of friction and its drawbacks, stick-slip theory of friction, friction measurement methods.

Unit 2:

Wear, lubricants and bearings: Cause, effect, classification and mechanism of wear, quantitative laws of wear, wear and wear rate, objective and properties of lubricants, synthetic lubricants, reasons of degradation of lubricating oils, lubricant additives, boundary lubrication, hydrodynamic lubrication, mechanism of elastohydrodynamic lubrication, classification of bearings, hydrostatic bearings, hydrodynamic bearings.

Unit 3:

Maintenance Management: Relevance of maintenance, maintenance: an over view, maintenance services, problems of the plant manager, automation and maintenance, maintenance objectives and costs, quality and quality circle in maintenance, Engineering reliability, maintainability. Maintenance Types/sytems: Planned and unplanned maintenance, breakdown, corrective, opportunistic, routine, preventive, predictive, CBM, Design out maintenance.

Unit 4:

Condition monitoring

NDT concepts, visual and temperarture monitoring, leakage monitoring, vibration monitoring, lubricant monitoring-methods, equipments, ferrography, spectroscopy, cracks monitoring, thickness monitoring, corrosion monitoing.

Reference Books:

1. Engineering Tribology by Choudhary
2. Maintenance planning and control- Kelly, A. Buttersworth & Co. 1984
3. Maintenance and spare parts Management – Krishanan G, Prentice Hall – 1991

MME-203A-1 Principles of metal casting

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study the basic concepts regarding design and manufacture of a component by various casting methods. To provide knowledge to the students, on the principles that guides production of sound engineering castings.

Course Outcomes:

At the end of the course the students should be able to:

1. Distinguish the different metals, their melting furnaces and applications in foundry technology
2. Design the pattern and gating system for preparing the mould
3. Describe the basic concepts of core and mould
4. Explain the different types of special casting methods
5. Discuss the various processes for improving or controlling the quality of casted product and environment of foundry shop.

Syllabus Contents:

Unit 1:

Introduction to casting process, Domestic and Engineering items made by casting process, Advantage and limitations of casting process over the other manufacturing processes.

Unit 2:

Ferrous and Non-ferrous casting metals & their alloys and items made of them. Melting furnaces for cast iron, cast steels, aluminium and copper. Pattern: Pattern material, Types of patterns, Pattern allowances, Colour coding system for patterns, Numerical on pattern allowances.

Unit 3:

Moulding: Mould material, properties of moulding sand, Main constituents of moulding sand, Classification of moulding sand, Preparation of moulding sand, Testing of moulding sand. Core: Introduction, Characteristics of core, Types of core, Core making, Core chaplets, Core print.

Unit 4:

Gating system: Requirements of gating system, elements of gating system, Types of gates, Types of risers, Calculation of pouring time and solidification time, Casting design considerations, Chills.

Unit 5:

Special casting methods: Gravity die casting, Cold chamber die casting, Hot chamber die casting, Investment casting, Centrifugal casting, Shell mould casting, Continuous casting

Unit 6:

Fettling of castings, Casting inspection, Heat treatment of castings, Quality control of castings, Pollution control in foundry, Modernization of foundry.

Reference Books:

1. Principles of Metal Casting - Richard W. Heine , Carl R. Hoper, Philip C. Rosenthal, Tata McGraw Hill Education
2. Principles of Foundry Technology - P. L. Jain, Tata McGraw-Hill Education
3. Foundry practice - W.H. Salmon and E.N. Simons, Pitman
4. Principles of manufacturing materials and processes - J. S. Campbell, McGraw Hill
5. Materials and processes in manufacturing - E. Paul DeGarmo, J. T. Black, Ronald A. Kohser, John Wiley & Sons
6. A Textbook of Production Technology: Manufacturing Processes - P. C. Sharma, S. Chand publications

MME-203A-2 Jigs & Fixture

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

This subject enables the student to learn and apply the design of different tools, both technical and economical aspects, with reference to various production equipment and components, such as jigs and fixtures, press tools for sheet metal working, molds for plastic injection molding, and die casting.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Study the basic principles in designing general jigs and fixtures, as well as molds and dies.
2. Assess the performance of a given tool design for meeting the specific design criteria.
3. Evaluate the effects of a given tool design on work quality.
4. Design the jig and fixture.

Syllabus Contents:

Unit 1:

Degree of freedom & Restrain, Location methods, Design of guide pins & dowel pins, Location of irregular geometrical product, Calculation of forces & Torque exerted by machining methods.

Unit 2:

Purpose types and functions of jigs and fixtures, Tool design objectives-Production devices-Inspection devices-Materials used in Jigs and Fixtures–Types of Jigs-Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis.

Unit 3:

Jigs, Drill bushes –different types of jigs –plate latch, channel, box post, angle plate, angular post, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of jigs forgiven components.

Unit 4:

Fixtures for machining and inspection, General principles of boring, lathe, milling and broaching fixtures-Grinding, planning and Shaping fixtures, assembly, Inspection and welding fixtures-Modular fixtures. Design and development of fixtures for given component.

Text Books:

1. Edward G Hoffman, "Jigs& Fixture Design", Thomson – Delmar Learning, 5004
2. Donaldson. C, "Tool Design", Tata McGraw-Hill, 1986

Reference Books:

1. Kempster,"Jigs &Fixtures Design", The English Language Book Society, 1978.
2. Joshi, P.H., "Jigs &Fixtures", 2nd Edition, Tata McGraw-Hill Publishing Company Limited.
3. Hiram E Grant, "Jigs and Fixture", Tata McGraw-Hill.
4. "Fundamentals of Tool Design", CEEE Edition, ASTME, 1983
5. PSG College of Technology, Coimbatore – Design Data Handbook

MME-203A-3 Computational Fluid Dynamics

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To provide the knowledge base essential for application of computational fluid dynamics to engineering flow problems Provide the essential numerical background for solving the partial differential equations governing the fluid flow Develop students' skills of using a commercial software package.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. To Understand solution of aerodynamic flows.
2. To Study the CFD software and its application. Simplify flow problems and them exactly Define and setup flow problem properly within CFD context, performing solid modeling.
3. To Understand CAD package and producing grids via meshing tool.
4. To Understand both flow physics and mathematical properties of governing.

Syllabus Contents:

Unit 1:

History of CFD: Comparison of the three basic approaches in engineering problems solving analytical .Experimental and computational methods. Beam advance in computational techniques.

Unit 2:

Problem formulation: The standard procedure for formulating a problem physical and mathematical classification of problems, types of governing differential equations.

Unit 3:

Methods of Discretisation: Basic of finite difference method: Finite element method. Finite volume method and spectral method. Treatment of boundary conditions.

Unit 4:

Numerical solution of Heat conduction problems: Steady-state problems: (i) One dimensional heat conduction transfer through a pinfin- din, two dimensional conduction through a plate unsteady state problem: One dimensional transient at conduction. Explicit and implicit methods. Stability of numerical methods.

Unit 5:

Numerical solution of fluid flow problems: Types of fluid flow and their governing equation : Viscous incompressible flows calculation of flow field using the stream function-vorticity method: calculation of boundary layer over a flat plate: Numerical algorithm for solving complete Navier-Stokes equation-MAC method SIMPLE algorithm: Project Problem.

Reference Books:

1. Numerical heat transfer and fluid flow by Suhas V.Patankar, taylor and francis.
2. Computational fluid dynamics by J.Anderson

MME-204A-1 Modeling & Simulation

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Learn to develop mathematical models of phenomena involved in various chemical engineering processes and solutions for these models.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the important physical phenomena from the problem statement
2. Develop model equations for the given system,
3. Demonstrate the model solving ability for various processes/unit operations
4. Demonstrate the ability to use a process simulation.

Syllabus Contents:

Unit 1:

Concept of system system environment, elements of system, system modelling, types of models, Monte Carlo method .System simulation-a management laboratory, advantages &limitations of system simulation, continuous & discrete systems.

Unit 2:

Simulation of Continuous systems: Characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formation

Unit 3:

Simulation of discrete systems: Time flow mechanisms, discrete and continuous probability density functions, Generation of and from numbers, testing for and omnes sand for auto correlation, generation of random variants for discrete distribution.

Unit 4:

Simulation of Queuing system: Concept of queuing theory, characteristics of queues, stationary &time dependent queues, Queue discipline, time series analysis, measure of system performance, kendal' s notation, simulation of singles ever queues multi-server queues.

Unit 5:

Simulation of inventory systems: Rudiments of inventory theory, MRP, in process inventory, necessity of simulation I inventory problems, forecasting & regression analysis, forecasting through simulation.

Unit 6:

Design of simulation experiments: Length of run, elimination of initial bias, variance reduction techniques, stratified sampling ,antipathetic sampling, common random numbers.

Unit 6:

Simulation languages: Continuous & discrete simulation languages, block structure, continuous languages, special purpose simulation languages, SIMSCRIPT, GPSS, SIMULA, importance & limitation of special purpose languages.

Reference Books:

1. System simulation by Gordon
2. System simulation by Hira

MME-204A-2 Industrial Inspection

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study industrial process of inspection, design consideration for gauges and measuring instruments. To study Indian and international standards for limits, fits, tolerances. To identify geometrical and physical limitations in measuring devices. To study surface texture of components.

Course Outcomes:

At the end of the course, the student should be able to

1. Understand about various types of gauges.
2. Design the gauges.
3. Analyze the surface texture.
4. Understand tolerances and their positioning with geometry.
5. Understand geometrical and physical limitations in measuring devices.

Syllabus Contents:

Unit 1:

Design consideration for Gauges and measuring instruments: material selection for gauges, NAS per Indian and international standards, design of plug gauge, snap gauge, center distance gauge.

Unit 2:

Inspection of threads and gears: thread gauge design; thread size measurement by two wire and three wire methods, vernier gear tooth gauge design.

Unit 3:

Surface textures: components of machined surface texture, specification of surface texture, surface roughness measuring device and techniques, design of pneumatic gauges in process gauging methods.

Unit 4:

Geometrical and positional tolerances.

Unit 5:

Geometrical and physical limitations in measuring devices.

Reference Books:

1. Metrology:- I .C. Gupta (Dhanpat Rai Pub.)
2. Engg. Metrology :- R. K. Rajput (S. K. Kataria and sons)
3. Metrology :- R. K. Jain
4. PSG design data book for Gauge design

MME-204A-3 Robotics and Automation

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

The Robotics and Mechanisms area seeks to promote research and develop technologies that enable systems to exhibit intelligent, goal-oriented behavior, and developing innovative instruments to monitor, manipulate, and control systems. Overall, our research spans the following areas: humanoid robots, intelligent control systems, flexible manipulators, mechanism theory, micro sensors and actuators, and compliant mechanism. We focus on enabling technologies that necessitate novel design solutions in terms of development of new methods of synthesis, analysis & optimization of novel robots and mechanisms.

Course Outcomes:

At the end of the course, the student should be able to

1. Study the Robotics and Mechanisms area seeks to promote research and develop technologies that enable systems to exhibit intelligent, goal-oriented behavior, and developing innovative instruments to monitor,
2. Manipulate, and control systems. Overall, our research spans the following areas: humanoid robots, intelligent control systems,
3. Study the various flexible manipulators, mechanism theory, micro sensors and actuators, and compliant mechanism.
4. Understand the various technologies that necessitate novel design solutions in terms of development of new methods of synthesis, analysis & optimization of novel robots and mechanisms.

Syllabus Contents:

Unit 1:

Introduction to Robot Technology: Robot Physical configuration, basic Robot motions. Types of Manipulators: Constructional features, advantages and disadvantages of various kinematic structures, servo and Non- servo manipulator. Actuators and Transmission System: Pneumatic, Hydraulic and Electrical actuators and their characteristics and control systems. Feed Back Systems and Sensors: Encoders and other feed back systems, vision, ranging systems, textile sensors.

Unit 2:

Programming Languages: Description of VAN, RAII and other Languages. Artificial Intelligence: Logged Locomotion, Export system. Concept of spatial description and transformations, manipulator Kinematics; Inverse manipulator, Kinematics Jacobians; velocities and static forces; manipulator dynamics, position control of manipulators, force control of manipulators, robot programming languages and systems. Concept of automation in Industry, mechanisation and automation classification of automation systems.

Unit 3:

Air Cylinders- their design and mountings, pneumatic and hydraulic valves, flow control valves metering valves, direction control valves, hydraulic servo systems, pneumatic safety and remote control circuits.

Unit 4:

Basis of Automated work piece handling: Working principles and techniques, job orienting and feeding devices. Transfer mechanisms automated feed out of components, performance analysis. Assembly automation, automatic packaging and automatic Inspection.

Reference Books:

1. CAD/CAM by Groover and Elimmers (Jr.) CAD/CAM Handbook, Bed ford Masschusettes.

2. Automation Production Systems & Computer Aided Manufacturing. Robotics for Engineers by Royen MIT Press.

3. Robot Manipulators by Paul MIT Press. Robotics by Hall & Hall. Robot Motion by Brady MIT Press.

4. Numerical Controlled Computer Aided manufacturing by Press man and Elimmers, John Wiley & sons. New York.

MME-204A-4 Quality control techniques

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study about statistical concepts in quality control, quality control techniques, various control charts. Study about variables inspection and attributes inspection, relative merits and demerits. To study about special control charts for variables, group control chart total quality control.

Course Outcomes:

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

1. Understand about the Concept of Quality control system and process capability study.
2. Analyze about process control charts and Errors.
3. Understand about the Inspection control methods.
4. Understanding about the probability theory, binomial and Poisson distribution .
5. Analyze product control, chance and assignable causes of Quality variation .

Syllabus Contents

Unit 1:

Statistical concepts in Quality Control, Graphical Representation of Grouped Data, Continuous and Discrete Probability Distributions, control limit Theorem,

Unit 2:

Introduction to Quality Control, process Control and Product Control, Chance and Assignable causes of Quality variation, Advantages of shewhart control charts, Process Control charts for variables, X, R and σ charts, fixation of control limits, Type I and Type II Errors, Theory of runs, Interpretation of Out of Control points, Probability limits, Initiation of control charts, Trial control limits, Determination of aimed at value of Process Setting, Rational method of sub

grouping, control chart parameters, control limits and specification limits, Natural tolerance limits, Relationship of a process in Control to upper and lower specification limits, process capability studies.

Unit 3:

Special control charts for variables, group control chart, arithmetic moving X and R charts, Geometric moving chart, control chart with reject limits, steady trend in Process average with constant dispersion, trend chart with sloping limits, variable subgroup size.

Unit 4:

Variables inspection and Attributes inspection, Relative merits and demerits, Control charts for Attributes, p chart and np chart, varying control limits, high defectives and low defectives, special severe test limits, C chart, U chart, Dodge demerit chart, Quality rating, CUSUM or Cumulative sum control chart, Average run length (ARL) Relative efficiency or sensitivity of control chart.

Unit 5:

Probability theory, binomial and Poisson distribution, Acceptance Inspection, 100% Inspection, No Inspection and sampling Inspection, operating characteristic curve (O.C. curve). Effect of sample size and Acceptance number, type A and type B O.C. curves, Single, Double and Multiple sampling Plans, SS Plan. Acceptance/Rejection and Acceptance/Rectification Plans, Producers Risk and Consumer's Risk, Indifference Quality level, Average Outgoing quality (AOQ) curve, AOQL, quality protection offered by a sampling Plan, Average sample Number (ASN) curve, Average Total Inspection (ATI) curve.

Reference Books:

1. Statistical Quality control by E.L. Grant
2. Quality control and Industrial Statistics, by A.J. Duncan
3. Quality control by Dale H. Bestefield
4. Total Quality Control by A.Y. Feigenboum
5. Elementary S.O.L. by I.W.Burr, M. Dekkar.

MME-205A Mechanical Engineering Lab-III

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Theory : 35 Marks
Total : 50 Marks

Course Objectives:

To develop domain knowledge in the field of mechatronics product design and select various equipment's for mechatronics applications. To run a variety of mechanical equipment's with the help of computer.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the various practical demonstrations of mechatronics.
2. Utilize the theories for designing digital system.
3. Selection of equipment's and practical demonstration.
4. Prepare computer programme based on mathematical model.

Syllabus Contents:

1. To verify truth table of various gates such as AND, OR, NOR, NOT, etc.
2. To realize a logic equation Y=AB+CD.
3. Selection of sensor for a particular application from Catalogue/Internet.
4. Design a mechatronics product/system and incorporate application of mechatronics for enhancing product values
5. To study the hardwares and softwares of mechatronics kit.
6. To move a table in X-direction and Y-direction within the range of proximity sensors using Control-X software.
7. To rotate a table using DAC system.
8. To run a motor with PLC.
9. To run a conveyor with computer.
10. To study the movement of actuating cylinders and sensors.

11 To study mechatronics and their interfacing in a CNC machine.

12. Life prediction from computer programme based on mathematical model.

MME-206A Mechanical Engineering Lab-IV

No. of Credits: 2 | Sessional: 15 Marks

L T P Total | Theory : 35 Marks

0 0 4 4 | Total : 50 Marks

Course Objectives:

Tribology studies combines issues of friction, wear and lubrication into a framework for designing and maintaining the machine world. Until recently, "the design of the shape and material" was being done on the basis of machine dynamics and strength of materials but the predominant part of failure i.e. wear remained neglected.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. To Study the various tribological processes and tribological relevant properties of materials.
2. To determine the various engineering materials having potential for tribological application.
3. To verify the Characterization and evaluation of Ferrous materials for tribological requirements/applications,
4. To Understand the Selection of ferrous materials for rolling element bearings, gears, crank shafts, piston rings, cylinder liners, etc.

Syllabus Contents:

1. To study the introduction to maintenance techniques. preventive and predictive Maintenance
2. To study and perform Non-Destructive Testing techniques, liquid dye penetrant and leak testing.
3. To study and perform Eddy current testing & Ultrasonic testing.
4. To study and perform Magnetic particle detection and Particle counter.
5. To study wear Analysis through thermography and Ferrography.
6. To study and perform Pin on wear disc apparatus
7. To study wear, lubricants and bearings

8. To study and perform on Journal bearing apparatus, hydrodynamic and hydrostatic bearing apparatus.

MME-207A Mini-Project

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks

Course Outcomes:

At the end of the course:

1. Students will get an opportunity to work in actual industrial environment if they opt for internship.
2. In case of mini project, they will solve a live problem using software/analytical/computational tools.
3. Students will learn to write technical reports.
4. Students will develop skills to present and defend their work in front of technically qualified audience.

Syllabus Contents:

Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

Semester –III

MME-301A-1 Tool & Die Design

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

This subject enables the student to learn and apply the design of different tools, both technical and economical aspects, with reference to various production equipment and components.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the basic principles in designing general jigs and fixtures, as well as molds and dies.
2. Assess the performance of a given tool design for meeting the specific design criteria.
3. Analysis the effects of a given tool design on work quality
4. Design the dies.

Syllabus Contents

Unit 1:

Tools Materials and their heat treatment, Mechanism and geometry of chip formation, effect of large and small shear angles on chip thickness and length of shear planes study of cutting forces, friction forces, mean shear strength coefficient of for cutting,

Unit 2:

Method of calculating the metal remove rate. Influence of rake angle side cutting edge & nose radius on cutting forces. Relationship between temperature and hardness of cutting tool materials, Tool geometry of single point and Multipoint Cutting Tool.

Unit 3:

Press working terminologies and elements of dies and strip lay out, Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements.

Unit 4:

Design and development of dies, Design and development of progressive and compound dies for Blanking and piercing, operations. Bending dies – development of bending dies- forming and drawing dies- Development of drawing dies. Design considerationsin forging, extrusion, casting and plastic dies.

Unit 5:

Plastic as a tooling material, commonly used plastic for tooling material, application of epoxy plastic tools, Construction methods of plastic tooling, Metal forming operation with Urethane dies. Calculating forces for Urethane pressure pads.

Text Books:

1. Tool Design by Cyril Donation, George H. Lecain, V C Goold.
2. Edward G Hoffman, “Jigs& Fixture Design”, Thomson – Delmar Learning, 5004
3. Donaldson.C, “Tool Design”, Tata McGraw-Hill, 1986

Reference Books:

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society, 1978
2. Joshi, P.H., “Jigs &Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, 5004
3. Hiram E Grant, “Jigs and Fixture”, Tata McGraw-Hill, 5003
4. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983

5. PSG College of Technology, Coimbatore - Design Data Handbook

MME-301A-2 Method Engineering & Ergonomics

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To provide knowledge necessary to either initiate a new or improve an existing ergonomics program for controlling health and performance problems; to educate and convince management of the cost benefits of an ergonomically sound workplace; to proactively identify potential risks and determine cost effective and sustainable jobsite modifications.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand ergonomics and its three major components. Outline the components of an ergonomics program.
2. Describe the components of office and shop floor ergonomic evaluations.
3. Study the common risk factors and areas for ergonomic improvement within foundries.
4. Describe how to evaluate, select and implement ergonomic solutions.
5. Describe the essential elements for an effective ergonomics business case.

Syllabus Contents

Unit 1:

Introduction to industrial engineering and productivity, measurement of productivity, Introduction to work study, methods study principles and motion economy, Filming Techniques and micro-motion analysis, Introduction to work measurement. Time study, performance allowances, works sampling.

Unit 2:

Introduction of Ergonomics, system approach to ergonomic model, .Area of study covered under ergonomics, man/machine systems, characteristics of man machine system, limitation of man & machine with respect to each other. Design approach: Work Design consideration, General principles for carrying out the physical activities, Design of workplace, machine at workplace, seat for workplace.

Unit 3:

Controls: Criteria for control design, Hand controls and foot controls, Relationship between controls and display instruments, Controls for high precision work (Push Buttons, switches, knobs etc.), Layout of panels and machine

Displays:-Types of displays, Design recommendation for quantitative displays.

Unit 4:

Climates:-Heat Humidity-Fundamentals of human thermal regulation, measuring the thermal environment, work in hot climate, work in cold climate protection against climatic extremes, effect to climate on performance.

Unit 5:

Noise:- Terminology, physiological effects of noise, annoyance of noise, speed interference, hearing loss, temporary and permanent threshold shift, effect of noise on performance reduction of noise, personal noise protection.

Text Books:

1. Method Engineering study-Krick,S.V.
2. Work study and Ergonomics-Suresh Dalela, Saurabh.

Reference books:

1. Introduction of Ergonomics- Bridger – Tata McGraw Hill
2. Work Study-Khanna-Dhanpat Rai & Sons

MME-301A-3 Computer Integrated Manufacturing

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Study the basic concepts of computer integrated manufacturing, NC,CNC and DNC system. Illustrate the numerical control and part programming. Study the concept of computer aided quality control and material handling.

Course Outcomes:

At the end of the course the students should be able to:

1. Apply robotic control and sensors for quality improvement.
2. Understand the role of CAD/CAM in improving product life cycle.
3. Understand different concepts of FMS.
4. Prepare and analyse numerical control programming.
5. Understand computer aided testing to various equipments.

Syllabus Contents:

Unit 1:

Introduction to CIM. Applications of computers in CIM. Numerical Control: basic components of NC system, NC motion control, system, applications of NC, advantages and disadvantages of NC.

Unit 2:

Conventional Numerical Control: Problems with conventional NC, NC controller technology, computer Numerical control, advantages of CNC, functions of CNC, Direct Numerical Control, components of a DNC system, functions of DNC, advantages of DNC.

Unit 3:

NC part programming: introduction, punched tapes in NC, tape coding and format, NC words, manual part programming, computer assisted part programming, APT language.

Unit 4:

Industrial robots and their applications for transformational and handling activities. Configuration and motions. Actuators, sensors and end effectors. Features like work envelope, precision of movements, weight carrying capacity. Introduction to intelligent robots.

Unit 5:

FMS and CQAC: Introduction, components of a FMS, types of systems, where to apply FMS technology, FMS workstation, planning the FMS. Computer aided quality control: Introduction, the computer in QC, contact and non-contact Inspection methods- optical and non-optical, computer aided testing. Coordinate measuring machine (CMM).

Unit 6:

Computer Integrated Manufacturing systems: Introduction, Technologies used in CIM, Difference between CIM and FMS, CIM hierarchy system, Implementation process of CIM, applications and benefits of CIM.

Reference Books:

1. CNC Technology and Programming—Tilak Raj
2. Automation, Production systems and Computer Integrated Manufacturing :- Groover M. P. (PHI)
3. CAD/CAM : - Zimmers and Groover (PHI)
4. Approach to computer integrated design and manufacturing :- Nanua Singh (John Wiley and sons)

MME-302A Dissertation Phase-I

No. of Credits: 10 Sessional: 50 Marks

L T P Total Theory : 150 Marks

0 0 20 20 Total : 200 Marks

Course Outcomes:

At the end of the course:

1. Students will learn to survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
2. Students will be able to use different experimental techniques.
3. Students will be able to use different software/ computational/analytical tools.
4. Students will be able to design and develop an experimental set up/ equipment/test rig.
5. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
6. Students will be able to either work in a research environment or in an industrial environment.

Syllabus Contents:

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

Semester –IV

MME-401A Dissertation Phase- II

No. of Credits: 16
L T P Total
0 0 32 32

Sessional: 125 Marks
Theory : 375 Marks
Total : 500 Marks

Course Outcomes:

At the end of the course:

1. Students will develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will.
2. Students will learn to write technical reports and research papers to publish at national and international level.
3. Students will develop strong communication skills to defend their work in front of technically qualified audience.

Syllabus Contents:

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

OPEN ELECTIVES

OEC-101A Business Analytics

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course outcomes

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.

Course objective

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Unit 1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation,

competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6: Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference Books::

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

2. Business Analytics by James Evans, persons Education.

OEC-102A Industrial Safety

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Contents:

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference Books::

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OEC-103A Operations Research

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Outcomes:

At the end of the course, the student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

Syllabus Contents:

Unit 1: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.

Unit 2 Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.

Unit 3: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.

Unit 4: Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5: Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Reference Books::

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008

2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009

5. Pannerselvam, Operations Research: Prentice Hall of India 2010

6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

OEC-104A Cost Management of Engineering Projects

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course contents:

Unit 1: Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit 2: Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Unit 3: Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

Unit 4: Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit 5: Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Reference Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

OEC-105A Composite Materials

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Contents:

UNIT–I: Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method-Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. Hand Book of Composite Materials-ed-Lubin.

2. Composite Materials – K.K.Chawla.

3. Composite Materials Science and Applications – Deborah D.L. Chung.

4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

OEC-106A Waste to Energy

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course outcomes:

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Reference Books::

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Audit Courses

AUD-01A English for Research Paper Writing

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Note: Ensure the good quality of paper at very first-time submission

Course Contents:

Unit 1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Unit 2: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

Unit 3: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit 5: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Unit 6: useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

AUD-02A Disaster Management

Course Objectives: -Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Unit 1: Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2: Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit 3: Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Unit 4: Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data From Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.

Unit 5: Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Unit 6: Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Readings:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

AUD-03A Sanskrit for Technical Knowledge

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. Learning of Sanskrit to improve brain functioning.
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Course Contents:

Unit 1: Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit 2: Order, Introduction of roots, Technical information about Sanskrit Literature.

Unit 3: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output:

Students will be able to

1. Understanding basic Sanskrit language.
2. Ancient Sanskrit literature about science & technology can be understood.
3. Being a logical language will help to develop logic in students.

AUD-04A Value Education

Course Objectives

Students will be able to

1. Understand value of education and self- development.
2. Imbibe good values in students.
3. Let the should know about the importance of character

Course Contents:

Unit 1: Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2: Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

Unit 3: Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Unit 4: Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Suggested reading

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

Course outcomes

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

AUD-05A Constitution of India

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit 1: History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working).

Unit 2: Philosophy of the Indian Constitution: Preamble, Salient Features.

Unit 3: Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit 4: Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit 5: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different

departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 6: Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

AUD-06A Pedagogy Studies

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Course Contents:

Unit 1: Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

Unit 2: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit 3: Evidence on the effectiveness of pedagogical practices. Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4: Professional development: alignment with classroom practices and follow-up support, Peer support. Support from the head teacher and the community. Curriculum and assessment. Barriers to learning: limited resources and large class sizes.

Unit 5: Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUD-07A Stress Management by Yoga

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Course Contents:

Unit 1: Definitions of Eight parts of yog. (Ashtanga)

Unit 2 Yam and Niyam. Do`s and Don't's in life i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3: Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects- Types of pranayama.

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also.
2. Improve efficiency

AUD-08A Personality Development through Life Enlightenment Skills

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Course contents

Unit 1: Neetisatakam-Holistic development of personality

Verses- 19,20,21,22 (wisdom)

Verses- 29,31,32 (pride & heroism)

Verses- 26,28,63,65 (virtue)

Verses- 52,53,59 (dont's)

Verses- 71,73,75,78 (do's)

Unit 2: Approach to day to day work and duties.

Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,

Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,

Chapter 18-Verses 45, 46, 48.

Unit 3: Statements of basic knowledge.

Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68

Chapter 12 -Verses 13, 14, 15, 16,17, 18

Personality of Role model. Shrimad Bhagwad Geeta:

Chapter2-Verses 17, Chapter 3-Verses 36,37,42,

Chapter 4-Verses 18, 38,39

Chapter18 – Verses 37,38,63

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.

2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.