SYLLABUS

Heat Power Engineering

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**III/II**	**3**	**-**	**-**	**3**
Subject Name		**Pump , Blower and Compressor**				
Subject Code		**MMEHE20S301**				
Paper	**English**					
	Hindi					
Max. Marks		**100**				

Course Objectives:

By taking this course student will be able to

1. Identify the use of Pump, Blower and Compressors.
2. Analyze the working of Pump, Blower and Compressor.
3. Learn the application of Pump, Blower and Compressor.

Course Outcomes:

CO1: Select suitable Pump.

CO2: Design a reciprocating pump and analyse its performance.

CO3: Design a centrifugal pump and analyse its performance.

CO4: Demonstrate basic principles of fans and blowers.

CO5: Design fan/blower and analyse its performance.

Unit	Syllabus	Periods
UNIT-I	**Centrifugal and Axial Flow Pumps:** Law of momentum, Vortex theory of Euler's head. Hydraulic performance of pumps; Cavitations, Losses in Pumps, Priming, Jet pumps. The centrifugal pump, definitions, pump output and efficiency, multistage centrifugal pumps, axial flow pump, Design of pumps, Pumps in series and parallel.	**10**
UNIT-II	Power Transmitting Turbo-machines, Introduction, theory, fluid of hydraulic coupling, torque converter. **Analysis of centrifugal blowers and fans:** Centrifugal Blowers: Theoretical characteristic curves - Euler's characteristics and Eulers velocity triangles - losses and hydraulic efficiency - flow through impeller inlet volute – diffusers leakage disc friction mechanical losses multi-vane impellers of impulse type - cross-flow fans.	**12**
UNIT-III	**Analysis of Compressor:** Rotor design airfoil theory - vortex theory - cascade effects - degree of reaction - blade twist stage design - surge and stall - stator and casing - mixed flow impellers.	**11**
UNIT-IV	**Testing And Control Of Fans** Fan testing - noise control - materials and components blower regulation - speed control – throttling - control at discharge and inlet.	**10**
UNIT-V	**Applications Of Blowers**: Applications of blowers - induced and forced draft fans for air conditioning plants - cooling towers - ventilation systems - booster systems.	**12**

Text Books:

1. S.M. Yahya, "Fundamentals of Compressible Flow", New Age International Pvt. ltd, 1996.
2. Stepanoff A.J., Turbo blowers, John Wiley & Sons, 1970.
3. Brunoeck, Fans, Pergamon Press, 1973.

Reference Books:

1. Austin H. Church, Centrifugal pumps and blowers, John Wiley and Sons, 1980.
2. Dixon, Fluid Mechanics, Thermodynamics of turbo machinery Pergamum Press, 1984.
3. Dixon, Worked examples in turbo machinery, Pergamon Press, 19845. Meguid, S.A., Fracture Mechanics,- John Wiley & Sons,1996.

SYLLABUS

Heat Power Engineering

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**III/II**	**3**	**-**	**-**	**3**
Subject Name		**Wind Energy**				
Subject Code		**MMEHE20S302**				
Paper	**English**					
	Hindi					
Max. Marks		**100**				

Course Objectives:

By taking this course student will be able to:

1. Judge qualitatively how the terrain influences the wind resource.
2. Calculate and analyze wind resource and energy production for a wind turbine from wind speed distribution, wind shear and power curve by and large describe and motivate the design of typical wind turbines.
3. Explain the main differences between horizontal and vertical axis wind turbines regarding design and properties.
4. make some dimensioning calculations for wind turbines.
5. Describe typical control methods for wind turbines, as well as control problems.

Course Outcomes:

After attending this course student will be able to:

CO1: Explain History of wind energy.

CO2: Describe wind characteristics.

CO3: Understand the socioeconomic effect of wind energy.

CO4: Discuss experimental investigations related to wind energy.

CO5: Describe various techniques to use wind energy.

Unit	Syllabus	Periods
UNIT-I	**Unit I Introduction:** Historical uses of wind, History of wind electric generations.	**10**
UNIT-II	Wind Characteristics: Metrology of wind, World distribution of wind, Atmospheric stability, Wind speed variation with height, Wind speed statistics, Weibull statistics, Weibull parameters, Rayleigh and normal distribution. Wind Measurements: Biological indicators, Rotational anemometers, other anemometers, Wind direction.	**12**
UNIT-III	**Wind Turbine Power, Energy and Torque:** Power output from an ideal turbine, Aerodynamics, Power output from practical turbines, Transmission and generation efficiency, Energy production and capacity factor, Torque at constant speeds, Drive train oscillations, Turbine shaft power and torque at variable speeds.	**11**
UNIT-IV	**Wind Turbine Connected to the Electrical Network:** Methods of generating synchronous power, AC circuits, the synchronous generator, per unit calculations, the induction machine, Motor starting, Capacity credit features of electrical network. **Wind turbines with Asynchronous Electric Generators:** Asynchronous systems, DC shunt generator with battery load, Per unit calculation, Self excitation of the induction generators, Single phase operation the induction generator, Field modulated generators, Roesel generator.	**10**
UNIT-V	**Asynchronous Load:** Piston water pumps, Centrifugal pumps, Paddle wheel heaters, Batteries, Hydrogen economy, and Electrolysis cells.Economics of Wind Systems: Capital costs, Economic concepts, Revenues requirements, Value of wind generated electricity.	**12**

Text Books:

1. Garg L Johnson: “Wind Energy Systems” Prentice Hall. Inc., New Jersey, 1985.
2. Desire Le Gouriers: “Wind Power Plants: Theory and Design” Pergamon Press, 1982.

SYLLABUS

Heat Power Engineering

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	-	-	3
Subject Name		Alternative Fuels For IC Engines				
Subject Code		MMEHE20S303				
Paper	English					
	Hindi					
Max. Marks		100				

Course Objectives:

By taking this course student will be able to

1. To present a problem oriented in depth knowledge of Alternate fuel and energy system.
2. To address the underlying concepts and methods behind alternate fuel and energy system.

Course Outcomes:

CO1: Know the properties and application of conventional fuels.

CO2: Know the properties and application alternative fuels.

CO3: Know the production method of various alternative fuels.

CO4: Know about various electric and hybrid vehicles.

CO5: Know about fuel cell and its working.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, meritsand demerits of various alternate fuels, introduction to alternate energy sources. LikeElectric vehicle, hybrid, fuel cell and solar cars.	10

UNIT-II	**Alcohols:** Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.	**12**
UNIT-III	**CNG, LPG, Hydrogen and Biogas:** Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG, LPG and Biogas using in SI & CI engines, Hydrogen; storage and handling, performance and safety aspects.	**11**
UNIT-IV	**Vegetable Oils:** Various vegetable oils for engines, transesterification, biodiesel and its properties, performance, emission and combustion characteristics of engine. **Electric and Hybrid Vehicle:** Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybridvehicle.	**10**
UNIT-V	**Fuel Cell and Solar:** Fuel cell vehicles, specifications, system components, selection of fuel cell, thermal management, maintenance, advantage and limitations, Solar powered vehicles, specifications, system components, advantage and limitations.	**12**

Text Books:

1. M.K. Gajendra Babu, K.A. Subramanian, Alternative Transportation Fuels: Utilization in Combustion Engines, CRC Press, 2013.
2. Richard L. Bechfold, Alternative Fuels Guide Book - SAE International Warrendale, 1997.

Reference Books:

1. B. P. Pundir, Engine Emissions, Alpha Science International Limited, 2007.
2. B. P. Pundir, IC Engines Combustion and Emissions, Alpha Science International Limited, 2010.
3. Nagpal, Power Plant Engineering, Khanna Publishers - 1991.

SYLLABUS

HEAT POWER ENGINEERING

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**III/II**	**3**	**0**	**0**	**3**
Subject Name		**BUSINESS ANALYTICS**				
Subject Code		**MMEHP20S304**				
Paper	**English**	**English**				
	Hindi					
Max. Marks		**100**				

Course Objectives:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques.
3. Understand relationships between the underlying business processes of an organization.

Course Outcomes:

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

CO1. Students will demonstrate knowledge of data analytics.

CO2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.

CO3. Students will demonstrate the ability to use technical skills in predicative.

CO4. Prescriptive modeling to support business decision-making.

CO5. Students will demonstrate the ability to translate data into clear, actionable insights.

Unit	Syllabus	Periods
UNIT-I	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.	**8**

UNIT-II	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.	**9**
UNIT-III	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.	**11**
UNIT-IV	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.	**13**
UNIT-V	Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	**14**

Text Books:

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

Reference Books:

1. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Inter science Publication, USA, 1989.
2. I. J. Nagarath and D. P. Kothari, Modern Power System Engineering, Tata McGraw Hill publishers, New Delhi, 1995.
3. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA.

SYLLABUS

HEAT POWER ENGINEERING

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**III/II**	**3**	**0**	**0**	**3**
Subject Name		**Industrial Safety**				
Subject Code		**MMEHP20S305**				
Paper	**English**	**English**				
	Hindi					
Max. Marks		**100**				

Course Objectives:

1. Industrial safety is needed to check all the possible chances of accidents for preventing loss of life and permanent disability of any industrial employee, any damage to machine and material.
2. It is needed to eliminate accidents causing work stoppage and production loss.
3. It is needed to reduce workman's compensation, insurance rate, and all the cost of accidents.

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

CO1: The safety and productivity of people, machines, and processes is a key element of any sustainable business.

CO2: Industrial safety systems have been used for many years to perform safety functions in the manufacturing industries.

CO3: Safety is best achieved by inherently safe process design, Protection layer systems such as sensors, alarms, and personal protection equipment.

CO4: Apply standard safety procedures in an industrial environment.

CO5: These may be combined with protective systems to address any residual identified and counter risk.

Unit	Syllabus	Periods
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.	**8**
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.	**9**
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.	**11**
UNIT-IV	**Fault tracing:** Fault tracing-concept and importance, decision tree concept, 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, Electrical motors, Types of faults in machine tools and their general causes.	**13**
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.	**14**

Text Books: **1.** Maintenance Engineering, H. P. Garg, S. Chand and Company. **2.** Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
Reference Books: **1.** Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

SYLLABUS

HEAT POWER ENGINEERING

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**III/II**	**3**	**0**	**0**	**3**
Subject Name		**Operations Research**				
Subject Code		**MMEHP20S306**				
Paper	**English**	**English**				
	Hindi					
Max. Marks		**100**				

Course objective:

1. Understand the role and application of PERT/CPM for project scheduling.
2. Know how to compute the critical path and the project completion time. Know how to convert optimistic.
3. Most probable and pessimistic time estimates into expected activity time estimates.

Course outcomes:

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

CO1: Apply the dynamic programming to solve problems of discreet and continuous variables.

CO2: Apply the concept of non-linear programming.

CO3: Carry out sensitivity analysis andto model the real-world problem and simulate it.

CO4: Understand the importance of ground improvement techniques in civil engineering construction activities.

CO5: Reinforced wall design using steel strip or geo-reinforcement.

Unit	Syllabus	Periods
UNIT-I	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.	**8**
UNIT-II	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.	**9**
UNIT-III	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.	**11**

UNIT-IV	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	**13**
UNIT-V	Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.	**14**

Text books:

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

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

Referencesbooks:

1. J.C. Pant, Introduction to Optimization, Operations Research, Jain Brothers, Delhi, 2008.

2. Hitler Libermann Operations Research, McGraw Hill Publication, 2009.

3. Pannerselvam, Operations Research, Prentice Hall of India, 2010.

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

SYLLABUS

Heat Power Engineering

Class		M.TECH	L	T	P	C
Semester/Year		III/II	-	-	20	10
Subject Name		Dissertation Phase – I				
Subject Code		MMEHE20S307				
Paper	English					
	Hindi					
Max. Marks		250				

Course Objectives:-

1. In this course unit, students will learn the process of research proposal writing, conducting research, and political science writing.
2. The focus is on preparing the Special Degree students for their research and dissertation writing.
3. To enable students to learn practical aspects of research.

Course Outcomes:-

Students will be able to:-

CO1: Ability to synthesize knowledge and skills previously gained and applied to an in-depth

CO2: Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.

CO3: Ability to present the findings of their technical solution in a written report.

CO4: Presenting the work in International/ National conference or reputed journals.

CO5: Using linear programming approach using software.

Dissertation Phase – I

Guidelines for Dissertation Phase – I

1. As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
2. The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
3. After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred Model Curriculum of Engineering & Technology PG Courses [Volume -II].
4. Literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits- Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
5. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
6. **Phase – I deliverables:** A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
7. **Phase – I evaluation:** A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A.
8. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

SYLLABUS

CONTROL SYSTEM

Class		M.TECH	L	T	P	C
Semester/Year		IV/II	-	-	32	16
Subject Name		Dissertation Phase – II				
Subject Code		MMEHE20S401				
Paper	English					
	Hindi					
Max. Marks		500				

Course Objectives:-

1. In this course unit, students will learn the process of research proposal writing, conducting research, and political science writing.
2. The focus is on preparing the Special Degree students for their research and dissertation writing.
3. To enable students to learn practical aspects of research.

Course Outcomes:

Students will be able to:

CO1: Ability to synthesize knowledge and skills previously gained and applied to an in-depth

CO2: Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.

CO3: Ability to present the findings of their technical solution in a written report.

CO4: Presenting the work in International/ National conference or reputed journals.

CO5: Using linear programming approach using software.

Dissertation Phase – II

Guidelines for Dissertation Phase – II

1. As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
2. The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
3. After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred Model Curriculum of Engineering & Technology PG Courses [Volume -II].
4. Literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits- Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
5. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
6. **During phase – II,** student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
7. **Phase – II deliverables:** A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.
8. **Phase – II evaluation:** Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work.