SYLLABUS

Additive Manufacturing

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	-	-	3
Subject Name		Advanced Composite Technologies				
Subject Code		MMEAM20S301				
Paper	English					
	Hindi					
Max. Marks		100				

Course Objectives:

By taking this course student will be able to

1. Select constituent materials to develop appropriate composites.
2. Attendees will learn how to specify, select and economically affordable, mechanical property conductive materials that will ensure long life for the intended structures while concurrently assuring a failsafe criterion.
3. This course would provide the option of the selecting alternative materials to the traditionally used choice for structures of need and interest and having far reaching practical application.

Course Outcomes:

CO1: Understand composite material and their reinforcements.

CO2: Select constituent materials to develop appropriate composites.

CO3: Analyze interfaces of composites for predicting their mechanical properties.

CO4: Develop metal matrix, ceramic matrix and polymer matrix composites with calculated values of constituents.

CO5: Analyze the performance of composites.

Unit	Syllabus	Periods
UNIT-I	Overview of the course, history and basic concept of composites, Types and constituents, reinforcement and matrices, interface and mechanism of	10

	strengthening. **Fundamental concepts:** Definition and Classification of Composites, particulate and dispersion hardened composites, continuous and discontinuous fiber reinforced composites MMC, PMC, CMC.	
UNIT-II	**Metal Matrix Composites Processing:** Liquid state processes, solid state processes and in situ processes. **Interface:** Role, reactions, bonding mechanisms and bond strength. **Properties and applications:** Strength, stiffness, creep, fatigue and fracture; thermal, damping and tribological properties.	**12**
UNIT-III	**Polymer Matrix Composites Processing:** Hand layup and spray technique, filament winding, pultrusion, resin transfer molding, bag and injection molding, sheet molding compound. Matrix resins-thermoplastics and thermosetting matrix resins.	**11**
UNIT-IV	**Reinforcing fibers:** Natural fibers (cellulose, jute, coir etc.), carbon fiber, glass fiber, Kevlar fiber, etc. Particulate fillers-importance of particle shape and size. Coupling agents-surface treatment of fillers and fibers, significance of interface in composites. short and continuous fiber reinforced composites, critical fibre length, and anisotropic behavior.	**10**
UNIT-V	**Ceramic Matrix Composites Processing:** Cold pressing & sintering, hot pressing reaction bonding processes, infiltration, in-situ chemical reaction, Sol-Gel and polymer pyrolysis, self - propagating high temperature synthesis. Carbon- carbon composites, Interfaces. Rule of mixtures. Stress, strain transformations. **Nanocomposites:** introduction to Nanocomposites, advantages disadvantages **Test methods:** Quality assessment, physical and mechanical property characterization.	**12**

Text Books:

1. Chawla, Composite Materials Science and Engineering, Springer.
1. Hull, An introduction to composite materials, Cambridge. Stephens, R.I. and Fuchs, H.O., Metal Fatigue in Engg. ,- Wiley, NY2001.
2. Finnie, I. and Heller, W.R., Creep of Engg. Materials, - Mc Graw Hill Book Co.,1959.

Reference Books:

1. Steven L. Donaldson, ASM Handbook Composites Volume 21, 2001.
2. Krishan K. Chawla, Composite Materials, Science and Engineering, Springer, 2001.
3. Suresh G. Advani, E. Murat Sozer, Process Modelling in Composites Manufacturing.

EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्
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SCHOOL OF ENGINEERING

SYLLABUS

Additive Manufacturing

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	-	-	3
Subject Name		Supply Chain Management				
Subject Code		MMEAM20S302				
Paper	English					
	Hindi					
Max. Marks		100				

Course Objectives:

By taking this course student will be able to

1. Understand the role of aggregate planning, inventory, IT and coordination in a supply chain.

Course Outcomes:

CO1: Understand the decision phases and apply competitive and supply chain strategies.

CO2: Understand drivers of supply chain performance.

CO3: Analyze factors influencing network design.

CO4: Discuss experimental investigations by predictions by other methods.

CO5: Analyze the role of forecasting in a supply chain.

Unit	Syllabus	Periods
UNIT-I	**Strategic Framework:** Introduction to Supply Chain Management, Decision phases in a supply chain, Process views of a supply chain: push/pull and cycle views, Achieving Strategic fit, Expanding strategic scope. **Supply Chain Drivers and Metrics:** Drivers of supply chain performance, Framework for structuring Drivers, Obstacles to achieving strategic fit.	10
UNIT-II	**Designing Supply Chain Network:** Factors influencing Distribution Network	12

	Design, Design options for a Distribution network, E-Business and Distribution network, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation.	
UNIT-III	**Forecasting in SC**: Role of forecasting in a supply chain, Components of a forecast and forecasting methods, Risk management in forecasting.	**11**
UNIT-IV	**Aggregate Planning and Inventories in SC:**Aggregate planning problem in SC, Aggregate Planning Strategies, Planning Supply and Demand in a SC, Managing uncertainty in a SC: Safety Inventory.	**10**
UNIT-V	**Coordination in SC:** Modes of Transportation and their performance characteristics, Supply Chain IT framework, Coordination in a SC and Bullwhip Effect.	**12**

Text Books:

1. Sunil Chopra and Peter Meindl, Supply Chain Management - Strategy, Planning and Operation, 4th Edition, Pearson Education Asia, 2010.
2. David Simchi-Levi, PhilpKamintry and Edith Simchy Levy, Designing and Managing the Supply Chain - Concepts Strategies and Case Studies, 2nd Edition, Tata-McGraw Hill, 2000.

Reference Books:

1. John J Coyle, et.al. 'Managing Supply Chains A Logistics Approach, 9th Edition, Cengage Learning, 2013.
2. Jeremy F Shapiro, 'Modeling the Supply Chain', 2nd Edition, Cengage Learning, 2007.

SYLLABUS

Additive Manufacturing

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	-	-	3
Subject Name		Product Design for Manufacturing and Assembly				
Subject Code		MMEMD20S303				
Paper	English					
	Hindi					
Max. Marks		100				

Course Objectives:

By taking this course student will be able to:

1. Understand the product design for assembly.
2. Understand the management of manufacturing at design level.
3. Learn about types of tools used in product design for manufacturing.
4. Understand the various manufacturing applications.

Course Outcomes:

CO1: Understand the quality aspects of design for manufacture and assembly.

CO2: Apply Boothroyd method of DFM for product design and assembly.

CO3: Apply the concept of DFM for casting, welding, forming and assembly.

CO4: Identify the design factors and processes as per customer specifications.

CO5: Apply the DFM method for a given product.

Unit	Syllabus	Periods
UNIT-I	**Introduction to DFM, DFMA:** How Does DFMA Work?, Reasons for Not Implementing DFMA, What Are the Advantages of Applying DFMA During Product Design?, Typical DFMA Case Studies, Overall Impact of DFMA on Industry.	10
UNIT-II	**Design for Manual Assembly:** General Design Guidelines for Manual Assembly, Development of the Systematic DFA Methodology, Assembly	12

	Efficiency, and Effect of Part Symmetry, Thickness, and Weight on Handling Time, Effects of Combinations of Factors, Application of the DFA Methodology.	
UNIT-III	**High speed Automatic Assembly & Robot Assembly:** Design of Parts for High-Speed Feeding and Orienting, Additional Feeding Difficulties, High-Speed Automatic Insertion, General Rules for Product Design for Automation, Design of Parts for Feeding and Orienting, Product Design for Robot Assembly.	**11**
UNIT-IV	**Design for Machining and Injection Molding:** Machining Using Single-Point & Multi point cutting tools, Choice of Work Material, Shape of Work Material, Machining Basic Component Shapes, Cost Estimating for Machined Components, Injection Molding Materials, The Molding Cycle, Injection Molding Systems, Molding Machine Size, Molding Cycle Time, Estimation of the Optimum Number of Cavities, Design Guidelines.	**10**
UNIT-V	**Design for Sheet Metal working & Die Casting:** Dedicated Dies and Press-working, Press Selection, Turret Press working, Press Brake Operations, Design Rules, The Die Casting Cycle, Auxiliary Equipment for Automation, Determination of the Optimum Number of Cavities, Determination of Appropriate Machine Size, Die Casting Cycle Time Estimation, Die Cost Estimation, Design Principles.	**12**

Text Books:

1. Geoffrey Boothroyd, Assembly Automation and Product Design, Marcel Dekker Inc., NY, 3rd Edition,2010.

Reference Book:

1. Geoffrey Boothroyd, Hand Book of Product Design, Marcel Dekker Inc., NY, 1992.

SYLLABUS

ADDITIVE MANUFACTURING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	0	0	3
Subject Name		BUSINESS ANALYTICS				
Subject Code		MMEAM20S304				
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:

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, NewDelhi,1995.
3. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA.

SYLLABUS

ADDITIVE MANUFACTURING

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**III/II**	**3**	**0**	**0**	**3**
Subject Name		**Industrial Safety**				
Subject Code		**MMEAM20S305**				
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:

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	**8**

	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.	**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 generalcauses.	**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

ADDITIVE MANUFACTURING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	0	0	3
Subject Name		Operations Research				
Subject Code		MMEAM20S306				
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

Machine Design

Class		M.TECH	L	T	P	C
Semester/Year		III/II	-	-	20	10
Subject Name		Dissertation Phase – I				
Subject Code		MMEAM20S307				
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:

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		MMEAM20S401				
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:-

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.