Department of Industrial & Production Engineering

School of Studies (Engineering & Technology)

Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur (C.G.) 495009

Website: www.ggu.ac.in **Phone (O):** 07752-260453

E-Mail: sharadscs2@gmail.com **Mobile No.:** 7250306654

Minutes of Meeting of Online Board of Studies

An online meeting of the board of studies (BOS) of the Department of Industrial & Production Engineering was held on 29.10.2021 at 3:00 P.M. The following members were present-

1. Prof. G.K. Agrawal (External Member),
   Professor, Govt. Engineering College, Bilaspur (C.G.)
2. Mr. Dalbir Singh Rekhi (External Member),
   Associate Vice President, Jindal Steel & Power Ltd., Angul (OD)
3. Prof. M.K. Singh (Member of B.O.S.),
   Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
4. Prof. S.C. Shrivastava
   Professor, & H.O.D Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
5. Mrs. Disha Dewangan (Member of B.O.S.)
   Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
6. Mr. C.P. Dewangan (Member of B.O.S.)
   Associate Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
7. Mrs. Arpita Roy Choudhary
   Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
8. Dr. Atul Kumar Sahu
   Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
9. Mr. Ganesh Prasad Shukla
   Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
10. Mr. Leeladhar Rajput
    Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
11. Mr. Nitin Kumar Sahu
    Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
12. Mr. Anurag Singh
    Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)
13. Mr. Kawal Lal Kurrey
    Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)

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14. Mr. Somnath Singroul
Assistant Professor, Deptt. of I.P.E., G.G.V., Bilaspur (C.G.)

In the meeting, Choice Based Credit System (CBCS) scheme, syllabus of ***M.Tech. CAD-CAM and Robotics*** was discussed in detail. All the suggestions of the members were incorporated and recommended for approval.

The CBCS scheme and syllabus of ***M.Tech. CAD-CAM and Robotics*** have been accepted by the B.O.S. (I.P.E.) were attached herewith and recommended for approval from the competent authority.

The B.O.S. Online meeting was concluded with vote of thanks by Head of the Department.

Prof. G.K.Agrawal

Prof. S.C. Shrivastava

Mrs. Arpita Roy Choudhary

Mr. Leeladhar Rajput

Mr. Anurag Singh

Mr. Dalbir Singh Rekhi

Mrs. Disha Dewangan

Dr. Atul Kumar Sahu

Mr. Nitin Kumar Sahu

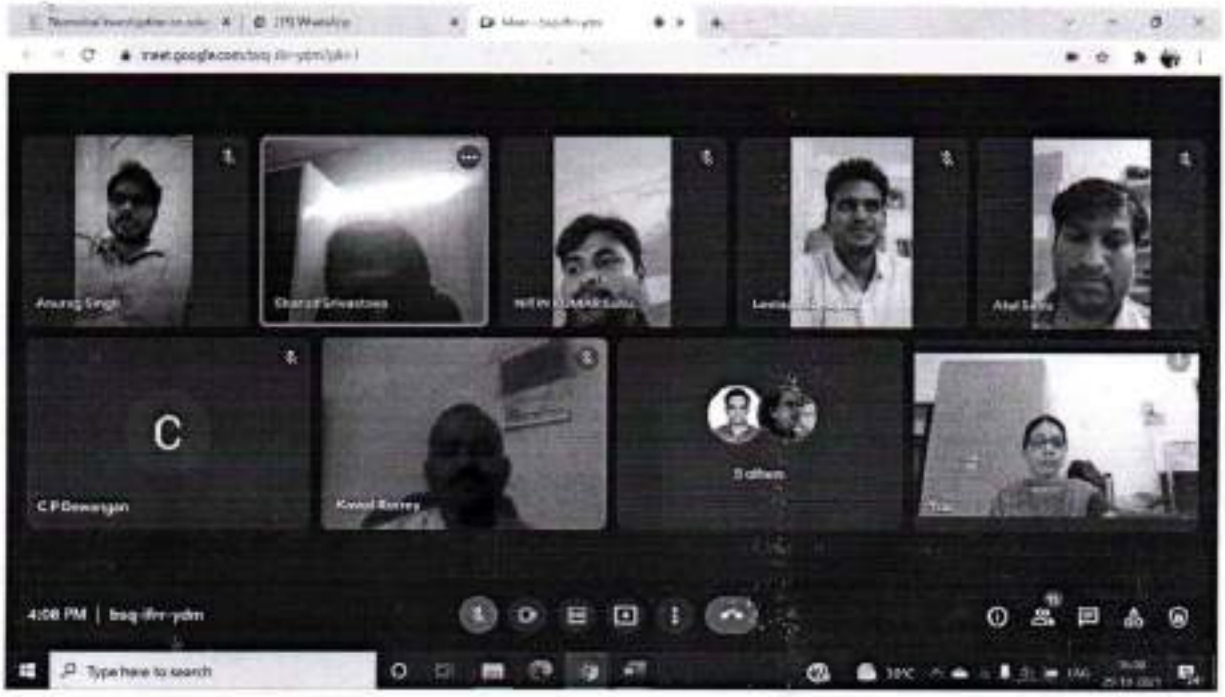
Mr. Kawal Lal Kurrey

Prof. M.K.Singh

Mr. C.P. Dewangan

Mr. Ganesh Prasad Shukla

Mr. Somnath Singroul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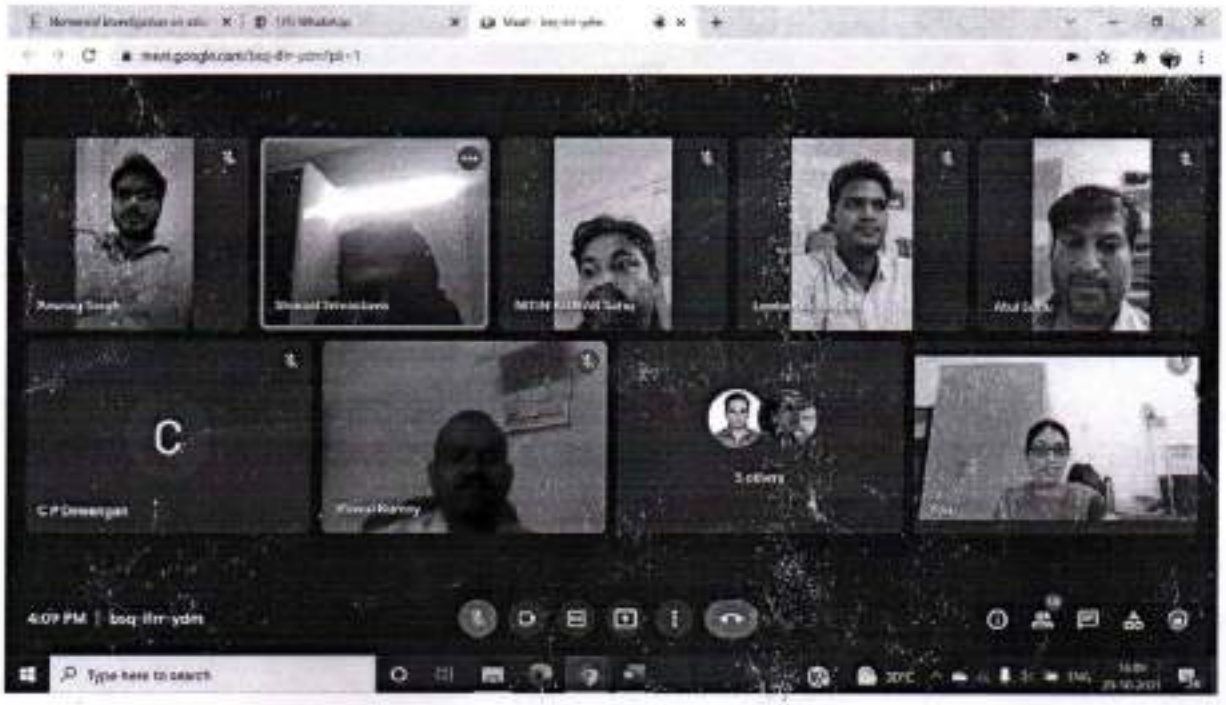
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C P Dewangan
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Dalbir Singh Rekhi
to me, gka2010 ▾

12:48 PM (9 minutes ago)

Dear Madam/ Sir,

Reference to the trail mail, the course content is okay.

With Regards,

D S Rekhi

On Wed, Nov 10, 2021, 12:38 Disha Dewangan <dewangan.disha@gmail.com> wrote

Dear Sir,

The Department of Industrial & Production Engineering conducted an online BOS of ***M.Tech. CAD-CAM and Robotics*** on 29.10.2021. Kindly give your consent via mail. pfa

Regards
Mrs. Disha Dewangan
BOS I/C

Dear Madam / Sir,

Reference to the trail mail, it may be noted that the course content is okay.

With Regards,

D S Rekhi

On Wed, Nov 10, 2021, 11:55 Disha Dewangan <dewangan.disha@gmail.com> wrote:

> Dear Sir,
> The Department of Industrial & Production Engineering conducted an online BOS of B.Tech III & IV SEM on 30.09.2021. Kindly give your consent regarding the syllabus.
> P.F.A
>
> Regards
> Mrs. Disha Dewangan
> BOS I/C
> Department of Industrial & Production Engineering

Dalbir Singh Rekhi
to me, gka2010 ▾
12:47 PM (9 minutes ago)

Dear Madam /Sir,

Reference to the trail mail, the course content is okay.

With Regards,

D S Rekhi

> On Wed, Nov 10, 2021, 12:01 Disha Dewangan <dewangan.disha@gmail.com> wrote:
> > Dear Sir,
> > The Department of Industrial & Production Engineering conducted an online BOS of B.Tech. VII, VIII Sem on 23.07.2021. Kindly give your consent regarding the syllabus.
> > P.F.A

Search mail

2 of 1,71

Compose

Inbox 36

Snoozed

Important

Sent

Drafts 49

Categories

Social 580

Meet

New meeting

Join a meeting

Hangouts

Something's not right.

Consent for syllabus

Inbox ×

gajendra agrawal Wed, Nov 10, 8:53 PM (14 hours

to me

Dear madam,
I give my consent for syllabus of BTech IP, 3,4,7,8 sem and M Tech CAD CAM and Robotics.
Regards
Dr G K Agrawal
Professor and Head
Dept of Mechanical Engineering
Government Engineering College Bilaspur
Mob 9406213464

Reply Forward

GURU GHASIDAS VISHWAVIDYALAYA
BILASPUR (C.G.)

(A Central University)
Koni, Bilaspur-495009, C.G (India)

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM (CBCS)

MASTER OF TECHNOLOGY
IN
CAD-CAM AND ROBOTICS

COURSE STRUCTURE AND SYLLABI

M.Tech. Regular Two Year Degree Program
(Effective from the academic year 2021-22)

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
SCHOOL OF ENGINEERING &TECHNOLOGY, GGV, BILASPUR, C.G. (INDIA)

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
SCHOOL OF ENGINEERING & TECHNOLOGY, GGV, BILASPUR, C.G. (INDIA)

SCHEME OF EXAMINATION

M.TECH. CAD-CAM and ROBOTICS

M.Tech. I-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPATT1	Computer Aided Design	3	0	0	40	60	100	3
2.	IPPATT2	Fundamentals of Robotics	3	0	0	40	60	100	3
3.	IPPATP1 IPPATP2 IPPATP3	Elective – I 1. Computer Integrated Manufacturing 2. Rapid Prototyping and Tooling 3. Supply chain management	3	0	0	40	60	100	3
4.	IPPATP4 IPPATP5 IPPATP6	Elective – II 1. Advanced Manufacturing Processes 2. Mechanics of Sheet Metal Forming 3. Micro-manufacturing	3	0	0	40	60	100	3
5.	IPPATP7 IPPATP8 IPPATP9	Elective – III 1. Modeling & Simulation 2. Theory of Vibration 3. Artificial Intelligence	3	0	0	40	60	100	3
6.	IPPATC1	Research Methodology& IPR	2	0	0	-	50	50	2
7.	IPPALT1	CAD-CAM lab	0	0	4	30	20	50	2
Total			17	0	4	230	370	600	19

M.TECH. CAD-CAM and ROBOTICS

M.Tech. II-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPBTT1	Finite Element Analysis	3	0	0	40	60	100	3
2.	IPPBTT2	Robotics and Control	3	0	0	40	60	100	3
3.	IPPBTP1 IPPBTP2 IPPBTP3	Elective – IV 1. Green Manufacturing 2. Advance Operation Research 3. Total Quality Management	3	0	0	40	60	100	3
4.	IPPBTP4 IPPBTP5 IPPBTP6	Elective – V 1. Mechanics of Composite Material 2. Smart Materials and Applications 3. Mechatronics in Manufacturing Systems	3	0	0	40	60	100	3
5.	MSPBTO1 IPPBTO2 IPPBTO3 CEPBTO4 MEPBTO5 CHPBTO6 ECPBTO7 MCPBTO8	Open Elective 1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy 7. IoT 8. MOOCs	3	0	0	40	60	100	3
6.	ELPBTX1 PEPBTX2 CEPBTX3 LAPBTX4	Audit Course/Value Added Course English for Research Paper Writing Stress Management by Yoga Disaster Management Constitution of India	2	0	0	0	0	0	0
7.	IPPBPT1	Mini Project/Seminar	0	0	4	30	20	50	2
8.	IPPBLT1	Robotics lab	0	0	4	30	20	50	2
		Total	17	0	08	260	340	600	19

Note: Under MOOCs the students have to opt any subject other than Industrial & Production Engineering from NPTEL/UGC SWAYAM

M.TECH. CAD-CAM and ROBOTICS

M.Tech. III-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPCPT1	Dissertation Stage–I	0	0	28	100	100	200	14
Total			0	0	28	100	100	200	14

M.TECH. CAD-CAM and ROBOTICS

M.Tech. IV-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	IPPDPT1	Dissertation Stage–II	0	0	32	100	200	300	18
Total			0	0	32	100	200	300	18

Total Credits for the Program = 19 + 19 +14 +18 = 70

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPATT1	Computer Aided Design	3	0	0	40	60	100	3

IPPATT1- COMPUTER AIDED DESIGN

Course Objectives

The objective of this course is to;

1. Get idea of basic fundamentals of computer graphics used in CAD hardware and software and its communications.
2. Introduce various algorithms and mathematical expressions of curves, surface and solid CAD model.
3. Impart knowledge of new design concept and optimization technique to generate surface and solid in CAD.
4. Introduce basic fundamental of finite element method (FEM) for design optimization of mechanical element.

Course Outcomes

After successful completion of this course studentsare able to;

1. Generate and interpret engineering design of mechanical parts according to engineering design standards and its role in graphic communication process.
2. Impart knowledge ofconceptual understanding of the principles of CAD systems, the

implementation of these principles, and its connections to CAE systems.

3. Comprehend the coordinate representation of 2-D and 3-D entity and formulate the geometric transformations and its projections.
4. Get knowledge of mathematical representations of curves, surface and solid model and analysis of designed object.
5. Analyze the solid model and able to calculate its property through basic fundamental of FEM.

COURSE CONTENTS

Module 1

Introduction and progressive development of CAD, CAD system evaluation criteria, hardware and software, hardware integration and networking, computer communication,color management and raster graphics, aliasing and anti-aliasing, lines, circle and ellipse algorithms, windowing, clipping and view port.

Module 2

Coordinate systems, fundamental of geometric transformations, homogeneous representations, concatenation and composite transformations, 2-D and 3-D geometric transformations, orthographic and oblique projections.

Module 3

Basics of curves, parametric and non-parametric curves, analytical and synthetic curves, parametric representation of analytical and synthetic curves, Hermite curves, curve manipulations, Bèzier curves, B-splines, rational curves, wire frame models.

Module 4

Mathematical representation of surfaces, analytical and synthesis surfaces, parametric representation of surfaces such as; plane surface, tabulated surface, revolve surface, ruled surface, coon's patch, bi-linear surface, Hermite bi-cubic surface, Furguson surface, Bèzier surface patch, B-Spline surface patch, NURBS surface patch.

Module 5

Progressive development and fundamental of solid modeling, solid primitives, primitive instancing (PI), set theories, regularized Booleans set operation (RBSO), constructive solid geometry (CSG), boundary representation (B-rep), sweep representations (SR), spatial occupancy enumeration, cellular and octree decomposition (CD), analytic solid modeling (ASM), introduction to finite element method (FEM), 1-D FEM analysis.

Text Books & References

1. Zeid I. & Subramanian R. S., CAD/CAM Theory and practice, Tata McGraw Hill.

2. Zeid I., Mastering CAD/CAM, McGraw Hill International.
3. Groover M.P. &Zimmers E., CAD/CAM: Computer-Aided Design and Manufacturing,
4. Pearson Education.
5. Rao P. N., CAD/CAM Principles and Applications, Tata McGraw Hill.
6. Alavala, CAD/CAM Concepts and Applications, Prentice Hall of India.
7. Krishnamurthy N., Introduction to Computer Graphics, Tata McGraw Hill.
8. NewmanW.M.&Sproull R.F., Principles of Interactive Computer Graphics, Tata McGraw Hill.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPATT2	Fundamentals of Robotics	3	0	0	40	60	100	3

IPPATT2-FUNDAMENTALS OF ROBOTICS

Course Objective

The objective of this course is to;

1. Provide the concept of automation and robots and its challenges in real world environment.
2. Introduce the concept of drives, actuators, sensors and machine vision used in robotics.
3. Impart knowledge of the gripper and control aspects of the robotic systems.
4. Introduce the working principles of intelligent autonomous vehicle (IAV) and quad-rotors unmanned aerial vehicle (QUAV).

Course Outcome

At the end of the course students will be able to;

1. Learn basic concepts associated with automation and robotics and aware of recent updates in robotics.
2. Recognize the application of various drives and actuators used in robotic system.
3. Understand the basic concept of sensors and machine vision system used in robotic system.
4. Acquire knowledge of working principles of grippers and control system used in robotics.
5. Learn concept of intelligent autonomous vehicle (IAV) and quad-rotors unmanned aerial vehicle (QUAV) used in industries and non-industries.

COURSE CONTENTS

Module-1

Automation concept and need, principles and strategies of automation, basic elements of an automated system, levels of automations, advanced automation functions, numeric control machine and robots, robot anatomy and classifications, laws of robotics, accuracy and repeatability, challenges of various robots, typical industrial and non-industrial applications of

robots.

Module -2

Introduction of robot drives and actuators, functions and classification of drive and actuator systems, selection of drives and actuators, pneumatic and hydraulic drives, motors used in robotics, arrangement of actuators in robots, error response, feedback and feed forward compensations, modeling of robot servos, computer controlled servo systems, selection of robot drives and actuators.

Module -3

Introduction to sensors and transducers, characteristicsand requirements of sensing devices, classifications and functions of sensors and transducers, various types of sensors, robot guidance with vision system, vision system devices, image acquisition, masking, sampling and quantization, image processing techniques, edge detection, segmentation, calibration of sensors and multisensory-controlled robot.

Module -4

Design aspect of gripper, functions and types of grippers, force analysis for various basic gripper systems, characteristics of control systems, types of controllers, open and closed loop control, robot and industrial control systems, continuous verses discrete control, control system components, motion interpolation, WAIT, SIGNAL and DELAY commands, subroutines, introduction to various types such as RAIL and VAL II etc, features of type and development of languages for recent robot systems.

Module- 5

Introduction of autonomous mobile robots (AMR) and quad-rotors unmanned aerial vehicles (QUAV), holonomic and non-holonomic, sensing and control, navigation algorithms, stability and controllability of intelligent automated vehicles (IAV) and QUAV, driver assistance and monitoring systems, road scene interpretation, need and necessity of IAV and QUAV, industrial and non-industrial applications of IAV and QUAV.

Text Books & References

1. John J. Craig, "Introduction to robotics", Addison Wesley Longman.
2. Nagrath I.J. & Mittal R.K., "Robotics &Control" Tata McGraw Hill.
3. Murphy, "Introduction of AI robotics", MIT press.
4. Siegwart R., Nourbakhsh I.R. & Scaramuzza D., "Introduction to Autonomous Mobile Robots", MIT press.
5. Rogelio Lozano, "Unmanned Aerial Vehicles: Embedded Control", Wiley Publisher.
6. Gareth J., Monkman, Stefan H., Ralf S. & Henrik S., "Robot Grippers", Wiley Publisher.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPATP1 IPPATP2 IPPATP3	Elective – I 1. Computer Integrated Manufacturing 2. Rapid Prototyping and Tooling 3. Additive Manufacturing Technologies	3	0	0	40	60	100	3

IPPATP1 COMPUTER INTEGRATED MANUFACTURING

Course Objectives:

The objective of this course is to

1. Emphasize the integration of manufacturing enterprise using computer-integrated manufacturing (CIM) technologies.
2. Employ CAD/CAM interface and other CIM subsystems.
3. Develop database management, facility layout, Group technology, teamwork, and manufacturing operations.

Course Outcomes:

At the end of the course students will be able to

1. Develop an understanding of computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.
2. Obtain an overview of computer technologies including computers, database and datacollection, networks, machine control, etc, as they apply to factory management and factory floor operations.
3. Describe the integration of manufacturing activities into a complete system.

COURSE CONTENTS

Module-1

Introduction: Evolution of CIM, scope of CIM, segments of generic CIM,Automated Process Planning- Process planning, group technology, variant and generative process planning methods, Al in processplanning,process planning software. CNC technology – Principles of numerical control, features ofCNC systems, programming techniques, capabilities of a typical NC CAM software, integration of CNC machines in CIM environment, DNC – Flexible manufacturing systems-Architecture, work stations.

Module-2

Manufacturing Systems: MRP II software, production control software, forecasting, masterproductionschedule, materials requirements planning, capacity requirements planning, shop floor control, shop floor data collection techniques, inventory management, purchase orders, bill of materials, standard product routing, job costing, marketing applications.

Module-3

Robotics, Automated Assembly and Inspection: Types of robots and their performance capabilities,programming of robots, hardware of robots, kinematics of robots, product design for robotized manufacturing, selecting assembly machines, feeding and transfer ofarts, applications of robots in manufacture and assembly, sensors. Automated quality control types of CMM, non-contact inspection methods, in process and post process metrology, flexible inspection systems. Computer Aided Inspection and on-line quality monitoring.

Module-4

Data Communications and Technology Management: Technology issues, configuration management, database systems, management of technology, networking concepts, Local area Network (LAN), SQL fundamentals, Manufacturing Automation protocols (MAP) and Technical and office protocols (TOP) fundamentals– CIM models, economics of CIM, implementation of CIM.

Module-5

Collaborative Engineering: Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrentengineering, supply chain management (SCM), Customerrelations management(CRM) Virtual Reality and Factory simulation, Agile and lean manufacturing, reverse engineering, Rapid prototyping.

Text Books & References

1. Manufacturing Engineering and Technology – SeropeKalpak Jain, and Steven R. Smith, Pearsoneducation.
2. Automation, Production systems and Computer Integrated Manufacturing System–Mikell P.Groover, PHI Publication.
3. Computer Integrated Manufacturing Hand Book – EricTeicholz and Joel Orr, McGraw Hill Publication.
4. Computer Integrated Manufacturing – Paul G. Ranky, CIMware Publishers.
5. CAD / CAM / CIM – Radhakrishnan, New Age International Publication.

IPPATP2 RAPID PROTOTYPING AND TOOLING

Course Objectives

The objective of this course is to

1. Familiarize the basic concepts of RPT
2. Recognize various process in RP
3. Analyze the principles of Rapid tooling and reverse Engineering.

Course outcome

After completion of the course, the students will be able to:

1. Use different techniques for processing of CAD models for rapid prototyping.
2. Apply fundamentals of rapid prototyping techniques.
3. Use appropriate tooling for rapid prototyping process.
4. Develop different rapid prototyping techniques for reverse engineering.

COURSE CONTENTS

Module 1

Introduction to Prototyping: Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

Module 2

Liquid-based Rapid Prototyping Systems:Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Module 3

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs. RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

Module 4

Rapid Prototyping Data Formats:STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magic's, Mimics, Solid View, View Expert, 3 D View, Velocity 2 , Rhino, STL View 3 Data Expert and 3 D doctor.

Module 5

RP Applications: Application: Material Relationship, Application in Design , Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Bio-molecules.

Text Books & References

1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
2. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.
3. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
4. Hilton P, Jacobs P F, Rapid Tooling: Technologies and Industrial Applications, CRC press.
5. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press.
6. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer.

IPPATP3 SUPPLY CHAIN MANAGEMENT

Course Objectives

The objective of this course is to

1. To define supply chain, its importance and management.
2. To categorize various drivers of Supply Chain for grasping effectual performance
3. To understand about uncertainty, risk management and forecasting.
4. To outline Competitive advantages, Distribution Networks and Supply Chain Strategies
5. To elaborate drivers and barriers of Distribution Networks in Practice.

Course Outcomes

After the completion of this course, students will be:

1. Demonstrate a basic understanding about Competition and Supply Chain Strategies
2. Acquire knowledge about distribution network, E-Business and Time-Series
3. Demonstrate technical understanding about demand, inventory, safety, pricing.
4. Implement decision making policies, infrastructure and optimum Design for handling Transportation Network.
5. Resolve uncertain and risk decision in decision making and can capably tailored

transportation and supply chain costs.

COURSE CONTENTS

Module 1

Building a Strategic Framework to Analyze Supply Chains: What Is a Supply Chain? TheObjective of a Supply Chain ,The Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of a Supply Chain, Examples of Supply Chains, Supply ChainPerformance: Achieving Strategic Fit and Scope, Competitive and Supply Chain Strategies,Achieving Strategic Fit, Expanding Strategic Scope, Supply Chain Drivers and Metrics, Drivers of Supply Chain Performance, framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing.

Module 2

Designing the Supply Chain Network: Designing Distribution Networks and Applications to e-Business the Role of Distribution in the Supply Chain, Factors Influencing DistributionNetwork Design, Design Options for a Distribution Network, e-Business and the DistributionNetwork, Distribution Networks in Practice.

Network Design in the Supply Chain: The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation, The role of IT in Network Design, Making Network Design Decisions in Practice.

Network Design in an Uncertain Environment: The Impact of Uncertainty on Network Design, Discounted Cash Flow Analysis, Representations of Uncertainty, Evaluating Network Design Decisions Using Decision Trees ,AM Tires: Evaluation of Supply, Chain Design Decisions Under Uncertainty, Risk Management and Network Design, Making Supply Chain Decisions Under Uncertainty in Practice

Module 3

Planning Demand and Supply in a Supply Chain: Demand Forecasting in a Supply Chain, The Role of Forecasting in a Supply Chain, Characteristics of Forecasts, Components of aForecast and Forecasting Methods, Basic Approach to Demand Forecasting, Time-SeriesForecasting Methods, Measures of Forecast Error, Forecasting Demand at Tahoe Salt, TheRole of IT in Forecasting, Risk Management in Forecasting, and Forecasting in Practice.

Aggregate Planning in a Supply Chain: The Role of Aggregate Planning in a Supply Chain, the Aggregate Planning Problem, Aggregate Planning Strategies, Aggregate Planning Using Linear Programming, Aggregate Planning in Excel. The Role of IT in Aggregate Planning, Implementing Aggregate Planning in Practice.

Planning Supply and Demand in a Supply Chain: Managing Predictable Variability, Responding to Predictable Variability in a Supply Chain, Managing Supply, Managing Demand, Implementing Solutions to Predictable Variability in Practice.

Module 4

Planning and Managing Inventories in a Supply Chain: Managing Economies of Scale in a Supply Chain, Cycle Inventory, The Role of Cycle Inventory in a Supply Chain, Economies of Scale to Exploit Fixed Costs, Economies of Scale to Exploit Quantity Discounts, Short-Term Discounting:

Trade Promotions, Managing Multiechelon Cycle Inventory, Estimating Cycle Inventory-Related Costs in Practice.

Managing Uncertainty in a Supply Chain: Safety Inventory, The Role of Safety Inventory in a Supply Chain, Determining Appropriate Level of Safety Inventory, Impact of Supply Uncertainty on Safety Inventory, Impact of Aggregation on Safety Inventory, Impact of Replenishment Policies on Safety Inventory, Managing Safety, Inventory in a Multiechelon Supply Chain, The Role of IT in Inventory Management, Estimating and Managing Safety Inventory in Practice.

Determining the Optimal Level of Product Availability: The Importance of the Level of Product Availability, Factors Affecting Optimal Level of Product Availability, Managerial Levers to Improve Supply Chain Profitability, Setting Product Availability for Multiple Products under Capacity Constraints, Setting Optimal Levels of Product Availability in Practice

Module 5

Designing and Planning Transportation Networks: Transportation in a Supply Chain, The Role of Transportation in a Supply Chain, Modes of Transportation and Their Performance Characteristics, Transportation Infrastructure and Policies, Design Options for a Transportation Network Trade-Offs in Transportation Design, Tailored Transportation, The Role of IT in Transportation Risk Management in Transportation, Making Transportation Decisions in Practice.

Managing Cross-Functional Drivers in a Supply Chain: Sourcing Decisions in a Supply Chain, the Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Supplier Scoring and Assessment, Supplier Selection-Auctions and Negotiations Contracts and Supply Chain Performance, Design Collaboration, The Procurement Process, Sourcing Planning and Analysis, The Role of IT in Sourcing, Risk Management in Sourcing, Making Sourcing Decisions in Practice.

Text Books:

1. Supply Chain Management: Janat Shah, Pearson Publications 2010.
2. Supply Chain Management: Sunil Chopra and Mein del, Fourth Edition, PHI 2010.
3. Supply Chain Management: A.S.Altekar PHI Second Ed.2006.
4. Logistics Management: James Stock and Douglas Lambert. McGraw Hill InternationalEd.2006.
5. Supply Chain Management for Global Competitiveness :Ed.B.S.Sahay McMillanPublication 2000
6. Emerging Trends in Supply Chain Management: Ed.B.S.Sahay McMillan Publication2000.
7. Logistics Management: Bowersox TMH 2004.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Elective – II	3	0	0	40	60	100	3
IPPATP4	4. Advanced Manufacturing Processes							
IPPATP5	5. Mechanics of Sheet Metal Forming							
IPPATP6	6. Micro-manufacturing							

IPPATP4 Advanced Manufacturing Processes

Course Objectives:

The objective of this course is to

1. Provide the in depth knowledge of the types of advanced manufacturing and machining processes (AMPs); evolution, and need.
2. Acquire fundamental knowledge and understanding of Production and Industrial Engineering and to know about the applications of advanced manufacturing processes
3. Make acquainted the various unconventional manufacturing processes
4. Create a congenial environment that promotes learning, growth and imparts ability to work with multi-disciplinary groups in professional, industry and research organizations
5. Encourage the students for developing the models of Advanced Manufacturing Processes

Course Outcomes:

On completion of this course, the students will be able to

1. Categorize different material removal, joining processes as per the requirements of material being used to manufacture end product.
2. Select material processing technique with the aim of cost reduction, reducing material wastage & machining time.
3. Identify the correct advanced manufacturing processes by formulating and determining the correct AMPs for development of various complex shaped geometries
4. Interpret foundry practices like pattern making, mold making, Core making and Inspection of defects.
5. Classify different plastic molding processes, Extrusion of Plastic and Thermoforming.
6. Select appropriate Joining Processes to manufacture any component.

COURSE CONTENTS

Module 1

Advanced foundry processes - metal mould, continuous, squeeze, vacuum mould, evaporative pattern, and ceramic shell casting.

Module 2

Non-Traditional Machining: Introduction, need, AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment, process characteristics, performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR, Surface finish, WEDM.

Module 3

Laser Beam Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electron Beam Machining - Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electro Chemical Machining – Principle of working, equipment, Material removal rate, Process

parameters, performance characterization, Applications.

Module 4

Advanced forming processes - electro-magnetic forming, explosive forming, electro-hydraulic forming, stretch forming, contour roll forming

Module 5

Advanced welding processes - EBW, LBW, USW

Text Books and References:

1. Manufacturing Engineering and Technology by Kalpak Jain, Addison Wesley, 1995.
2. Materials and Processes in Manufacturing (8th Edition), E.P. DeGarmo, J. T Black, R.A.Kohser, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
3. Advanced Machining Processes by V. K. Jain, Allied Publications.
4. Manufacturing Science, A. Ghosh, and A.K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi
5. Nontraditional Manufacturing Processes, G.F.Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7).
6. Introduction to Manufacturing Processes by John A Schey, Mc Graw Hill.
7. Non-Traditional Manufacturing Processes by Gary F Benedict, CRC Press.
8. Advanced Methods of Machining by J. A Mc Geough, Springer

IPPATP5 MECHANICS OF SHEET METAL FORMING

Course Objectives:

The objective of this course is to

1. Develop various metal forming processes
2. Generate the concept of plastic deformation during forming processes
3. Different laws and equations developed for solving metal forming problems

Course outcomes:

After completion of this course, the student should be able to:

1. Generate the concept of different metal forming process.
2. Approach metal forming processes both analytically and numerically
3. Design metal forming processes
4. Develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.

COURSE CONTENTS

Module 1

Classification of forming processes mechanism of metal forming, temperature of metal working, hot working, cold working, friction and lubricants. Rolling of metals: Rolling processes, forces and

geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations.

Module 2

Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging. Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, and production of seamless pipes.

Module 3

Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing. Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, and defect in formed parts.

Module 4

HERF, Electromagnetic forming, residual stresses, in-process heat treatment, computer applications in metal forming. Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming and drawing dies.

Module 5

Forming methods dies & punches, progressive die, compound die, combination die, Rubber forming, Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems

Text Books and References:

1. Mechanical Metallurgy / G.E. Dieter / Tata McGraw Hill, 1998. III Edition
2. Principles of Metal Working / Sunder Kumar
3. Principles of Metal Working processes / G.W. Rowe
4. ASM Metal Forming Hand book
5. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
6. Manufacturing Science, Amithab Gosh &A.K.Malik, East-West press 2001.

IPPATP6 MICRO-MANUFACTURING

Course Objectives:

The objective of this course is to

1. To introduce the principles fundamental and process mechanics of micromachining
2. To understand of mechanics at micro level machining.
3. To analyze on the mechanical/chemical behavior changes during micromachining/manufacturing.
4. To evaluate micro and macro machining, visualize micro machining process.

5. To understand application and advancements in the micro machining process.

Course Outcomes:

On completion of this course, the students will be able to

1. Acquire knowledge about different micro-machining processes.
2. Acquire knowledge about super finishing processes.
3. Understand about the capabilities of different micro-manufacturing processes.
4. Understand about the capabilities of different advanced micro-manufacturing processes.
5. Understand about the capabilities of traditional micro-manufacturing processes.

COURSE CONTENTS

Module 1

Introduction and classification of micromachining, Mechanical type micro machining processes: Abrasive jet micromachining (AJMM), Ultrasonic micromachining, abrasive water jet micro machining (AWJMM)

Module 2

Magneto-rheological finishing (MRF), Magneto-rheological abrasive flow finishing (MRAFF), Magnetic float polishing (MFP).

Module 3

Chemical and electrochemical type advanced machining processes, Electrochemical micromachining (EDMM), electrochemical micro deburring, Chemical and photochemical micromachining. Abrasive based nano finishing processes, Abrasive flow finishing (AFF), Chemo-mechanical polishing (CMP), Magnetic abrasive finishing (MAF)

Module 4

Thermo electric type micro-machining process, Electric discharge micromachining (EDMM), wire EDM, EDDG, ELID, Laser beam micro machining (LBMM), Electron beam micromachining (EBMM)

Module 5

Traditional mechanical micro-machining processes, Micro turning, micro milling, micro drilling.

Text Books & References

1. Introduction to micromachining, VK Jain, Narosa Publisher, New Delhi 2nd edition.
2. Micromachining methods, JA Mc Geough, Champan and Hall, London.
3. Micro manufacturing processes, VK Jain CRC Press.
4. Advanced machining processes, VK Jain, Allied Publisher New Delhi.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Elective – III	**3**	**0**	**0**	**40**	**60**	**100**	**3**
IPPATP7 **IPPATP8** **IPPATP9**	**6. Modeling & Simulation** **7. Theory of Vibration** **8. Artificial Intelligence**							

IPPATP7 MODELING & SIMULATION

Course Objectives:

The objective of this course is to

1. Design the importance of modeling to science and engineering.
2. Describe future trends and issues in science and engineering, and identify specific industry related examples of modeling in science and engineering.
3. Utilize the modeling Process to identify the key parameters of a model, estimate model outcomes, utilize a computational tool, e.g. MATLAB to implement the mathematical representation of the model, convey the results of the simulation accurately, validate the model with data, and discuss the quality and sources of errors in the model.
4. Conduct the transforming of continuous functions and dynamics equations into discrete computer representations.
5. Examine mathematical representations of functions - Describe and utilize linear and nonlinear functions to model empirical data. Visualize empirical data and the fitting function using a computational tool.

Course Outcomes:

On completion of this course, the students will be able to

1. Develop the techniques of modeling in the context of hierarchy ofknowledge about a system and develop the capability to apply the same to study systems through available software.
2. Analyze different types of simulation techniques.
3. Simulate the models for the purpose of optimum control by using software.
4. Identify different types of models and simulations, describe the iterative development process of a model, and
5. Explain the use of models and simulations for hypothesis testing and explain how models link the physical world, the virtual world and the science of prediction.

COURSE CONTENTS

Module 1

Introduction: Definition and components of a system, continuous and discrete systems. Modelling: Concepts of system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models. Simulation: Basics of simulation, Steps in simulation, Discrete event

system simulation, Advantages and disadvantages of simulation, Decision making with simulation.

Module 2

Statistical Models: Review of terminology and concepts, Useful statistical models, Discrete distributions, Continuous distributions, Poisson process, Empirical distributions, Random numbers, Techniques for random generation. Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems, Application of models.

Module 3

System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Distributed lag models, Cobweb models Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies.

Module 4:

Simulation software: Comparison of simulation packages with programming languages, classification of simulation software, Description of a general purpose simulation package, Design of scenario and modules, dialog box, database, animation, plots and output, interfacing with other software, summary of results. Examples with MATLAB/ AWESIM / ARENA.

Module 5

Analysis after simulation: Importance of the variance of the sample mean, Procedure for estimating mean and variance, Subinterval method, Replication Method, Regenerative method; Variance reduction techniques, Start up policies, Stopping rules, Statistical inferences, Design of experiments. Verification and validation of simulated models, optimization via simulation. Case studies on application of modeling and simulation in manufacturing systems.

Text books & References:

1. Averill M. Shaw, "Simulation Modeling and Analysis", Tata McGraw-Hill, 2007.
2. Frank L. Severance, "System Modeling& Simulation-an Introduction", JohnWiley& Sons, 2001.
3. Geoffrey Gordon, "System Simulation", Prentice Hall India, 1969.
4. Robert E. Shannon, "System Simulation: The Art and Science", Prentice Hall India, 1975.
5. Charles M Close and Dean K. Frederick Houghton Mifflin, "Modelling and Analysis of Dynamic Systems: TMH, 1993.
6. Allan Carrie, "Simulation of manufacturing", John Wiley & Sons, 1988

IPPATP8 THEORY OF VIBRATION

Course Objectives:

The objective of this course is to

1. Formulate mathematical models of problems in vibrations using Newton's second law or energy principles,
2. Determine a complete solution to the modeled mechanical vibration problems.

3. HartogDen,J.P."Mechanicalvibrations"TataMcGrawHills,4thedition1956)
4. MeirovitchL."elementsofvibarationanalysisMcGrawHills-1956
5. Anderson R. A. "Fundamentalsofvibration"Mecmillanpress1967
6. KbstadN.O. 'Fundamentalsofvibrationanalysis "McGrawHills-1956
7. RobertK.Vicrck "Vibrationanalysis"PublishedbyHarper&Row
8. Timoshenko S., Young D.H. &Ileavev W.Jr. "Vibration problem in engineering 4th ed, New York Willey1974
9. Merovitch, L.,*Analyticalmethodsinvibration"publishedby Macmillan (1967)

IPPATP9 ARTIFICIAL INTELLIGENCE

Course Objectives:

The objective of this course is to

1. To impart knowledge about Artificial Intelligence.
2. To give understanding of the main abstractions and reasoning for intelligent systems.
3. To enable the students to understand the basic principles of Artificial intelligence in various applications.

Course Outcomes:

On successful completion of this course, students will be able:

1. Solve basic AI based problems.
2. Define the concept of Artificial Intelligence.
3. Apply AI techniques to real-world problems to develop intelligent systems.
4. Select appropriately from a range of techniques when implementing intelligent systems.

COURSE CONTENTS

Module-1

Introduction to artificial intelligence and intelligent agents, categorization of AI, Production systems and rules for some AI problems: water jug problem, missionaries-cannibals problem etc. Solving problems by searching: state space formulation, depth first and breadth first search, iterative deepening.

Module-2

Intelligent search methods, memory restricted variants Heuristic search: Hill climbing, best-first search, problem reduction, constraint satisfaction. Game Playing: Minimax, alpha-beta pruning.

Module-3

Knowledge and reasoning: Propositional and first order logic, semantic networks, building a knowledge base,inference in first order logic, logical reasoning systems Planning: Components of a planning system, goal stack planning, non-linear planning strategies, probabilisticreasoning systems, Baysian networks.

Module-4

Learning:Overview of different forms of learning, Inductive learning, learning decision trees, computationallearning theory, Artificial neural networks. Evolutionary computation: Genetic algorithms, swarm intelligence, particle swarm optimization.

Module-5

Applications: Robotics, Natural language processing etc.

Text & Reference Books

1. Rich and Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2014.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, 2011.
3. Deepak Khemani, "A First Course in Artificial Intelligence", Tata McGraw Hill, 2013.
4. S. Russel and P.Norvig,"AI: A modern approach", 3rd Edition, Pearson Education, 2009.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPATC1	Research Methodology& IPR	2	0	0	-	50	50	2

IPPATC1 RESEARCH METHODOLOGY& IPR

Course Objectives

The objective of this course is to

1. To familiarize participants with basic of research and the research process.
2. To enable the participants with basic understanding of types of data and data collection methods.
3. To enable the participants in conducting research work and formulating research synopsis and report.
4. To familiarize participants with IPR.
5. To impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the research problem.

Course Outcomes:

On successful completion of this course, students will be able:

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. 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
5. Right to be promoted among students in general & engineering in particular.

COURSE CONTENTS

Module 1

Introduction and Design of research: Meaning, objectives and significance of research, types and parameters of research, research process, identification and definition of the research problem,

definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative vs. quantitative research methodology, field studies, field experiments vs. laboratory experiments, research design in social and physical sciences.

Module 2

Data and Methods of Data Collection: Survey, assessment and analysis: data collection, primary and secondary sources of data, Collection of primary data through questionnaire and schedules. Collection of secondary data, processing and analysis of data. Sample survey, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, area sampling and multistage sampling. Pilot survey, scaling techniques, validity & reliability.

Module 3

Data Analysis: Procedure for testing of hypothesis, the null hypothesis, determining levels of significance, type i and ii errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two way, chi square test and its application, students 'T' distribution, non-parametric statistical techniques, binomial test. Correlation and regression analysis – discriminate analysis – factor analysis – cluster analysis, measures of relationship

Module 4

Research report preparation and presentation: Review of literature: historical survey and its necessity, layout of research plan, meaning, techniques and precautions of interpretation, types of report: technical report, popular report, report writing – layout of research report, mechanics of writing a research report. Writing bibliography and references.

Module 5

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 grantsof patents, Patenting under PCT

Reference Books:

1. Research in education, By J W Best and J V Kahn, Pearson/ Allyn and Bacon.
2. Research Methodology – Methods and Techniques, C K Kothari, New Age International.
3. Design and Analysis of Experiments, D C Montgomery, Wiley.
4. Applied Statistics & Probability for Engineers, D C Montgomery & G C Runger, Wiley.
5. Management Research Methodology: Integration of Principles, Methods and Techniques, K N Krishnaswamy, A I Sivakumar and M Mathiranjan, Pearson Education.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPALT1	CAD-CAM lab	0	0	4	30	20	50	2

IPPALT1 CAD-CAM LAB

Course Objectives:

The objective of this course is to

1. Interpret drawings of machine components
2. Prepare assembly drawings both manually and using standard CAD packages

3. Familiarize the students with Indian Standards on drawing practices and standard components
4. Gain practical experience in handling 2D drafting and 3D modeling software systems
5. Analyze the features of CNC Machine Tool.
6. Expose students to modern control systems (Fanuc, Siemens etc.,)
7. Give exposure to software tools needed to analyze engineering problems.
8. Give exposure of different applications of simulation and analysis tools.

Course Outcomes

On successful completion of this course, students will be able:

1. Execute steps required for modeling 3D objects by using protrusion, cut, sweep, extrude commands
2. Convert 3D solid models into 2D drawing-different views, sections
3. Use isometric views and dimensioning of part models
4. Machine simple components on CNC machines
5. Use CAM software to generate NC code

List of Experiments

1. Use of commands of any computer aided drafting software package such as AutoCAD, Pro-engineer, CATIA etc.
2. Development of menu driven software for graphics using output primitives and for clipping of graphical entities.
3. Design of mechanical parts using geometric transformations such as translation, scaling, rotation, reflection etc.
4. Development of software for design of any mechanical element and system.
5. Development of software for analysis of one-dimensional element using FEM technique.
6. Development of computer program for analysis of mechanical element using FEM for user input values.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBTT1	Finite Element Analysis	3	0	0	40	60	100	3

IPPBTT1 FINITE ELEMENT ANALYSIS

Course Objectives

The objective of this course is to;

1. Implement the basic concept of Finite Element Analysis (FEA) in structural mechanics.
2. Solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach.
3. Formulate the design and heat transfer problems with application of FEM.

Course Outcomes

On successful completion of this course, students will be able:

1. Implement numerical methods to solve mechanics of solids problems.
2. Formulate and Solve axially loaded bar Problems.
3. Formulate and analyze truss and beam problems.
4. Implement the formulation techniques to solve two-dimensional problems using triangle and quadrilateral elements.
5. Formulate and solve Axi-symmetric and heat transfer problems.

COURSE CONTENTS

Module 1

Progressive development of FEA, nodes and elements, coordinate systems, application to the continuum, discretization of the domain, element shape, node, nodal element and coordinate system, shape functions, degrading technique, governing equations for continuum, pre-processor, processer and post processer.

Module 2

Strain displacement and elemental stiffness matrix, assembling of stiffness equation, boundary conditions and solution, direct approach, Galerkin's and virtual work method, discritisation of structure, analysis of spring, bar and trusses elements.

Module 3

Solution of plane stress and plane strain problems, iso-parametric formulations, analysis of beams and rigid frames, bending of thin plates, analysis of shells.

Module 4

Navier Solutions of Cross-Ply and angle-ply laminated simply-supported plates, determination of stresses finite element solutions for bending of rectangular laminated plates using CLPT and FSDT, formation of stiffness matrix, formation of load vector, numerical integration, post computation of stresses.

Module 5

Nonlinear Analysis, analysis of material and geometric nonlinear problems, adaptive finite analysis, automatic mesh generation, choice of new mesh, transfers variables.

Text & Reference Books

1. Rao S.S., "The Finite Element Method in Engineering", Elsevier Science & Technology.
2. Hutton D.V., "Fundamental of Finite Element Analysis", Mc Graw Hills.
3. Cook R.D., Malkus, D.S. and Plesha, M.E., "Concepts and Applications of Finite ElementAnalysis",3rdEd.,JohnWiley&Sons.
4. BatheK.J.,"FiniteElementProcedures",Prentice Hall of India, NewDelhi.
5. Huebner K.H. and Thorton, E.A., "The Finite Element Methods for Engineers" John Wiley &Sons.
6. Zienewiecz O.C. and Taylor, R.L., "The Finite Element Methods", Vol.1,Vol.2 and Vo1.3, Mc Graw Hill.
7. Belytshko,T., Liu, W.K. and Moran, B., Non-linear Finite Elements for Continua and Structures", Mc Graw Hills.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBTT2	Robotics and Control	3	0	0	40	60	100	3

IPPBTT2 ROBOTICS AND CONTROL

Course Objective

The objective of this course is to;

1. Study about mechanism, mechanics and mechanical behavior of the industrial robot.
2. Introduce the basic concept of arithmetic formulations and its analysis of the industrial robot.
3. Impart knowledge of kinematic, dynamic and trajectory behavior of the industrial robot.
4. Introduce the concept of controller design and the artificial intelligence used in the robotics.

Course Outcomes

On successful completion of this course, students will be able to;

1. Learn the basic concept of arithmetic modeling of industrial robots.
2. Analysis the forward and inverse kinematic behavior of industrial robots.

3. Understand the dynamic behaviors and trajectory generations of industrial robots.
4. Apply the concept of robot control theory and its application in robot controller.
5. Explore the concept of artificial intelligence and machine learning algorithms used in robotics.

COURSE CONTENTS

Module 1

Progressive development of robotics, man vs machine, specifications and classifications of industrial robot, robot specifications, links joints and terminology, mobility and degree of freedom, yaw, pitch and roll motion, equivalent angle, work envelop geometries, reach and stroke, repeatability, accuracy and precision, the mechanics and control of mechanical manipulator, operating environment, industrial applications.

Module 2

Spatial descriptions and transformations, coordinates frames matrices and their arithmetic, frame assignment to links, fundamental of rotation and translation, homogeneous coordinate frame, composite, inverse and skew homogenous transformation, description of position and orientation, Denavit-Hartenberg (D-H) parameters, arm equations, direct kinematic problems of industrial robots, inverse kinematics, algebraic and geometrical methods, inverse kinematic of roll pitch yaw joints, inverse kinematic problems of industrial robots, multiple solutions.

Module 3

Introduction to dynamics force, inertia and energy, principle of inertia tensor, joint velocity of manipulator, kinetic and potential energy of manipulator, Langrange-Euler formulation, equation of motion, dynamics problems of industrial robots, general description of path planning and trajectory generation, description of cartesian and joint space, manipulator Jacobians and velocity of manipulator, trajectory generation and obstacles avoidance of industrial robot.

Module 4

Introduction and system modeling of manipulator control theory, open loop and close loop control, first order and second order linear system, properties of the dynamic model, linear and nonlinear control techniques, performance and stability of feedback control, Proportional-Derivative (PD)control, Proportional-Derivative-Integral (PID) control, introduction of nonlinear control, multivariable robot control, computed torque control, adaptive control, hybrid control, manipulator interaction with environment, system stability and optimal control, applications and examples.

Module 5

Generation of robot programming languages and software packages, introduction to artificial intelligence, knowledge and reasoning, artificial neural network (ANN) and its applications in robotics, fuzzy logic theories and its applications in robotics. AI based techniques for navigation,

bio inspired algorithms, multiple robot coordination, design and application of intelligent controller.

Text Books & References

1. Fu K.S., Gonzalez R.C. and Lee C.S.G. "Robotics", McGraw Hill Education India.
2. John J. Craig, "Introduction to robotics", Addison Wesley Longman.
3. Schilling Robert J., "Fundamentals of Robotics", Prentice Hall of India.
4. Nagrath I.J. & Mittal R.K., "Robotics &Control" Tata McGraw Hill.
5. Murphy, "Introduction of AI robotics", MIT press.
6. Haykin S., "Neural Networks and Learning Machines", Pearson Publisher.
7. Yen J. & Langari R., "Fuzzy Logic: Intelligence, Control, and Information", Pearson Publisher.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBTP1 IPPBTP2 IPPBTP3	**Elective – IV** 1. **Green Manufacturing** 2. **Advance Operation Research** 3. **Total Quality Management**	3	0	0	40	60	100	3

IPPBTP1 GREEN MANUFACTURING

Course Objectives:

The objective of this course is

1. The graduates use their talent, self-confidence, knowledge and manufacturing practice which facilitate them to presume position of scientific and/or managerial leadership in their career paths towards green manufacturing.
2. Understand the three pillars of sustainability and how they are manifested in sustainable and green manufacturing.
3. Understand the basics of the green manufacturing concepts, strategy, different technology used to implement green manufacturing.
4. To create congenial environment that promotes learning, growth and imparts ability to work with inter- disciplinary groups in professional, industry and research organizations.
5. Understand Life Cycle Assessment approach to evaluate environmental impacts of product design, manufacturing processes, product use-phase, and product end-of-life.
6. To broaden and deepen their capabilities in analytical and experimental research methods, analysis of data, and drawing relevant conclusions for scholarly writing and presentation.
7. To provide guidance to students for their choices in research and professional career outlook and to encourage students to take up research.

Course Outcomes:

On successful completion of this course, students will be able:

1. Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
2. Graduate will become familiar with green manufacturing concepts and practices and analyze the problems within the domains of Green Manufacturing as the members of multidisciplinary teams.
3. Graduate will be trained towards developing and understanding the impact of environmental oriented components on global, economic, and societal context.
4. Explain the concept and principles of green manufacturing.
5. Plan good housekeeping practices for Industry/other places with concern of safety, hygiene and waste reduction.

COURSE CONTENTS

Module 1

Introduction: Sustainable development, indicators of sustainability, sustainability strategies, sustainable manufacturing,evolution of sustainable manufacturing, elements of sustainable manufacturing, theory of green manufacturing and its principles, need for green manufacturing, drivers and barriers of green manufacturing.

Module 2

Green manufacturing strategy: Manufacturing strategy, elements of manufacturing strategy, manufacturing out puts, competitive priorities: quality, delivery speed and reliability, cost efficiency,flexibility, order winners and order qualifier, tradeoff, production systems, manufacturing levers, competitive analysis, level of manufacturing capability, framework for formulating manufacturing strategy, implications of green manufacturing for manufacturing strategy.

Module 3

Life cycle approach of green manufacturing: Holistic and total Life-cycle approach, six step methodologies for green manufacturing (6-R approach), life cycle assessment (LCA), elements of LCA – Life Cycle Costing,Eco Labelingtarget setting, data collectionand processing, finalevaluation by virtue of criteria, environmental management systems.

Module 4

Green manufacturing technology: Definition of green manufacturing technology and practices, classifications of green manufacturing technology, advantages and disadvantages of implementation of green technology.

Module 5

Lean and Green manufacturing: Introduction, lean evolution &steps, introduction to lean manufacturing, definition of lean manufacturing, lean vs. green manufacturing: similarities and differences.

Text Books & References

1. Cleaner Production: Environmental and Economic Perspectives, Misra Krishna B., Springer, Berlin, Latest edition.
2. Environmental Management Systems and Cleaner Production, Dr. Ruth Hillary, Wiley, New York, Latest edition.
3. Pollution Prevention: Fundamentals and Practice, Paul L Bishop, TMH.
4. Costing the earth, Cairncrss and Francis, Harvard Business School Press – 2009.
5. The principle of sustainability, Simon Dresner, –Earth Scan publishers (2008).
6. Manufacturing strategy: How to formulate and implement a winning plan, Jhon Miltenburg, Productivity Press Portland, Oregon-2017.
7. Manufacturing strategy , Voss C. A, Chapman & Hall-1992
8. Manufacturing the future, Steve Brown, Prentice Hall, 2000
9. Manufacturing strategy, Terry Hill, Homewood, IL- 1989
10. Becoming Lean - Inside Stories of U.S. Manufacturers, Jeffrey K. Liker, Productivity Press, Portland, Oregon
11. G. Atkinson, S. Dietz, E. Neumayer, — "Handbook of Sustainable Manufacturing". Edward Elgar Publishing Limited, 2007.
12. D. Rodick, "Industrial Development for the 21st Century: Sustainable Development Perspectives", UN New York, 2007.
13. Rogers, P.P., Jalal, K.F. and Boyd, J.A., "An Introduction to Sustainable Development", Earth scan, London, 2007.
14. P. Lawn, "Sustainable Development Indicators in Ecological Economics", Edward Elgar Publishing Limited.
15. S. Asefa, "The Economics of Sustainable Development", W.E. Upjohn Institute for Employment Research, 2005

IPPBTP2 ADVANCE OPERATION RESEARCH

Course Objectives:

The objective of this course is

1. To explain the ideas about board education in the techniques and modeling concepts used toanalyze and design complex systems.
2. To compile the basic concepts of LPP and various solving techniques.
3. To make use of assignment, transportation, inventory and various other techniques.
4. To illustrate the connection between basics as well the advance tools of the subject todemonstrate the link between theory and its real world.
5. To define of single and multi variable optimization methods with and without constraints

Course Outcomes

On successful completion of this course, Students will be able to-

1. Recall and comprehend the LPP and its formulation with solving techniques.
2. Remember, understand and analyze the analytical solution of Simplex method, Assignment problem, Transportation problem and related topics questions with effective manner.
3. Understanding to apply basics as well the advance tools of the subject to demonstrate the link between theory and its real world applications.
4. Explain the overview of historical development and review of optimization techniques.

COURSE CONTENTS

Module 1

Introduction, Mathematical formulation of the problem, Graphical Solution methods, Mathematical solution of linear programming problem, Slack and Surplus variables. Matrix formulation of general linear programming Problem,

Module 2

The Simplex Method: Artificial variables, two phases Simplex Method, infeasible and unbounded LPP's, alternate optima, Dual problem and duality theorems, dual simplex method and its application in post optimality analysis, Revised Simplex method.

Module 3

Construction and solution of these Models, Hungarian method of solving assignment problem, unbalanced assignment problem, matrix form of transportation problem, Initial basic feasible solution, Balanced and unbalanced transportation problems, u-v method for solving transportation problems Selecting the entering variables, Selecting the leaving variables, Degeneracy in transportation Problem.

Module 4

Introduction and characteristics of dynamic programming, Methods of solution to DP.

Queuing Models, Elementary queuing models, Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.

Module 5

Classical Optimization Techniques, Introduction, Review of single and Multivariable optimization methods with and without constraints

Text Books & References

1. Operation Research, Theory and Application by J.K. Sharma, Macmillan India
2. Quantitative techniques in Management by N. D. Vohra, TMH
3. Operations Research by P.K. Gupta and D.S. Hira, S Chand and Sons
4. Operation Research: An Introduction by H.A. Taha
5. S. S. Rao, Optimization Techniques, Wiely Eastern

6. Operations Research, Kanti Swarup, S Chand

IPPBTP3 TOTAL QUALITY MANAGEMENT

Course Objectives:

The objective of this course is

1. Recognize the basic knowledge of History and Evolution of Quality Control and Management.
2. Illustrate the philosophy and core values of Quality Management (QM).
3. Developthe concepts and statistical methods employed for assurance of quality in products, processes and systems in an industrial environment.
4. Determine the effect of Process Capability Analysis and Introduction of Sampling Plans.
5. Apply and analyze the Concept of Reliability and Taguchi Philosophy for Quality

Course Outcomes:

On successful completion of this course, students will be able:

1. Develop conceptual understanding of Quality, Quality cost and value
2. Analyze and develop control charts for Statistical Quality Control.
3. To apply the knowledge of quality control and its tools for process capability.
4. Analyze and develop sampling plans for acceptance sampling.
5. Identify the concept of TQM and philosophy of quality leaders.
6. Identify failure pattern of product, Reliability and Maintenance.
7. Evaluate Reliability and MTTF and Examine Taguchi Philosophy for Quality improvement.

COURSE CONTENTS

Module 1

Introduction: Quality Control: Definitions, Place of quality control in industries,Quality control organization. Difference between inspection and quality control.Economics of Quality systems. Quality Assurance and its manual.

Module-2

Statistical Process Control: Sample size and frequency of sampling and control, Design and application of control charts for variable and attribute(X.R.C np, p, u chart). Process capability studies.

Module 3

Acceptance Sampling: AQL, LQL, Producer's Risk, Consumer's Risk, and Performance Measures of Sampling Plans: OC curve and ASN curve Single sampling plans. Double sampling and sequential sampling plans. Rectifying inspection for lots. Sampling plans for continuousproduction. Selection of sampling plans for different situations. Economics ofacceptance sampling.

Module 4

Total Quality Management: Evolution of total quality management. Historicalperspective. Elements

of TQM: elimination of waste and problem exposure. Totalquality control systems. Demings wheel, Deming 14 points-pros and cons in industrialengineering context, Philip Crosby philosophy, Juran Philosophy, Ishikawa Diagram.Quality function development, Quality circles & ISO 9000. Application of TQM toservice type organizations. Various Quality Awards

Module 5

Reliability: Distributions encountered in controlling Reliability mean time to failure, Exponential failure density, MTTF, Weibull, Failure density, Measurement and Tests, Maintenance and Reliability,. Robust Design and Taguchi Method Taguchi Philosophy for Quality Improvement, Quality Loss Function, Signal-to-Noise Ratio.

Text Books & References:

1. Grant E.L. and Leave Worth, Statistical Quality Control, TMH. 1996.
2. Amitava Mitra, Fundamentals of Quality Control and Improvement, Wiley, 2016.
3. Kapur K.C. and Lamberson, Reliability in Engg. Design Wiley Eastern.
4. Juran and Godfrey, Quality Handbook, TMH. 1998
5. Jain K.C. and Chitale A.K., Quality Assurance and Total Quality Management, Khanna Publisher, India, 2003.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBTP4 IPPBTP5 IPPBTP6	**Elective – V** 4. **Mechanics of Composite Material** 5. **Smart Materials and Applications** 6. **Mechatronics in Manufacturing Systems**	3	0	0	40	60	100	3

IPPBTP4 MECHANICS OF COMPOSITE MATERIAL

Course Objectives:

The objective of this course is

1. Understand the fundamental properties of composite materials;
2. Apply the fundamental principles mechanics of composite materials;
3. Apply modern analytical techniques to mechanical systems with composite materials;
4. Apply computational techniques to mechanical systems with composite materials;
5. Understand the manufacturing processes and cost analysis in composite materials;
6. Demonstrate effective communication and teamwork skills through technical presentations and reports in term projects.

Course Outcomes:

On successful completion of this course, students will be able

1. Determine composite mechanical properties from constituent fiber and matrix material properties including longitudinal and lateral moduli, Poisson's ratio, and shear modulus.
2. Determine the generalized stiffness and compliance matrix relating in-plane stresses to strains for a composite layer assuming plane stiffness.

of TQM: elimination of waste and problem exposure. Totalquality control systems. Demings wheel, Deming 14 points-pros and cons in industrialengineering context, Philip Crosby philosophy, Juran Philosophy, Ishikawa Diagram.Quality function development, Quality circles & ISO 9000. Application of TQM toservice type organizations. Various Quality Awards

Module 5

Reliability: Distributions encountered in controlling Reliability mean time to failure, Exponential failure density, MTTF, Weibull, Failure density, Measurement and Tests, Maintenance and Reliability,. Robust Design and Taguchi Method Taguchi Philosophy for Quality Improvement, Quality Loss Function, Signal-to-Noise Ratio.

Text Books & References:

1. Grant E.L. and Leave Worth, Statistical Quality Control, TMH. 1996.
2. Amitava Mitra, Fundamentals of Quality Control and Improvement, Wiley, 2016.
3. Kapur K.C. and Lamberson, Reliability in Engg. Design Wiley Eastern.
4. Juran and Godfrey, Quality Handbook, TMH. 1998
5. Jain K.C. and Chitale A.K., Quality Assurance and Total Quality Management, Khanna Publisher, India, 2003.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBTP4 IPPBTP5 IPPBTP6	**Elective – V** 4. Mechanics of Composite Material 5. Smart Materials and Applications 6. Mechatronics in Manufacturing Systems	3	0	0	40	60	100	3

IPPBTP4 MECHANICS OF COMPOSITE MATERIAL

Course Objectives:

The objective of this course is

1. Understand the fundamental properties of composite materials;
2. Apply the fundamental principles mechanics of composite materials;
3. Apply modern analytical techniques to mechanical systems with composite materials;
4. Apply computational techniques to mechanical systems with composite materials;
5. Understand the manufacturing processes and cost analysis in composite materials;
6. Demonstrate effective communication and teamwork skills through technical presentations and reports in term projects.

Course Outcomes:

On successful completion of this course, students will be able

1. Determine composite mechanical properties from constituent fiber and matrix material properties including longitudinal and lateral moduli, Poisson's ratio, and shear modulus.
2. Determine the generalized stiffness and compliance matrix relating in-plane stresses to strains for a composite layer assuming plane stiffness.

3. Apply classical laminated plate theory to determine extensional, coupling, and bending stiffnesses of a composite laminate. Also be able to perform this calculation using MATLAB for a composite laminate with many layers.
4. Fabricate composite laminates and built-up composite structures such as I-beams, box beams, or model-scale aircraft wings using a composite manufacturing procedure.

COURSE CONTENTS

Module 1

Introduction:-Definitionofcomposites;classificationofcomposites;Fibersandmatrix materialsandtheirproperties;generalizedHook'slaw-orthotropic,transversely isotropic and isotropic materials; constitutive equations under plane stress condition for orthotropicmaterials,restrictionsonelasticconstantsoforthotropicmaterials.

Module 2

MacromechanicsofLamina:-Stress-strainrelationsforalaminaofarbitraryorientation, invariantpropertiesofanOrthotropiclamina,strengthofanOrthotropiclamina,experimental determination of strength and stiffness, Biaxial strength theories of an Orthotropic lamina: maximum stress theory, maximum strain theory, Tsai-Hill theory, Tsai-Wu Tensor theory.

Module 3

MicromechanicsofLamina:-Mechanicsofmaterialsapproachtostiffness(determination ofE_1,E_2,U_{12}&G_{12});mechanicsofmaterialsapproachtostrength;tensileandcompressive strengthinfiberdirections,elasticityapproachtostiffness,someresultsofexactsolution.

Module 4

MicromechanicsofLaminate:-Classicallaminationtheories(CLT)-laminatestress, laminate stiffness- A-B-D matrix and their implication, symmetric and non-symmetric laminatesinterlaminatestress,limitationsofclassicallaminationtheory.

Module 5

Short Fiber Composites: -Theories of stress-transfer, average fiber stress, modulus prediction,strengthprediction,effectofmatrixductility,Ribbon–Reinforcedcomposites.

Text & Reference books:

1. "Modern Composite Materials" by L J Broutman and R M Krock,
2. "Composite Materials – Science and Engineering" by K K Chawla,
3. "Mechanisms and Mechanics of Composite Fracture" by R B Bhagat and S G Fishman,
4. "An Introduction To Composite Materials" by D Hull, "STRUCTURAL COMPOSITE MATERIALS" by F C Campbell,
5. "Composite Materials" by Berthelot, "Electrostatic Discharge Sensitivity of Composite Energetic Materials" by Michelle L Pantoya and Chelsea Weir

IPPBTP5 SMART MATERIALS AND APPLICATIONS

Course Objectives

The objective of this course is

1. Describe different types of smart materials in terms of underlying mechanisms, advantages and disadvantages
2. Select the most appropriate smart material system for a design problem under specified design constraints
3. Possess a general picture of smart material systems and knowledge about current research areas and future trends.
4. Design of sensors and actuators using smart materials and learn about Energy harvesting using piezoelectric materials
5. Describe Magneto rheological fluid and its applications

Course Outcome

On completion of this course, the students will be able to

1. Design and construct simple functional structures using smart materials.
2. Describe and characterize mechanical behavior of smart materials.
3. Characterize interaction between smart materials and simple structures in actuation and sensing.
4. Describe and characterize novel functions of smart materials using structure-property relationships.
5. Present and demonstrate the functions of smart structures.

COURSE CONTENTS

Module 1

Definition of smart materials, what makes them smart, sensors, actuators and transducers; introduction to different types of smart material, Smart materials; history and industrial application

Module 2

Piezoelectric materials – Crystallography and crystal structure, mechanism of piezoelectricity, Common piezoelectric materials, Applications, Derivation of constitutive laws from energy principle and its application as actuator, sensor, and energy harvester.

Superelasticity, superelastic materials phase transformation

Module 3

Shape memory alloys – Martensitic transformations, shape memory effect andsuper- elasticity, Mechanical behaviour and shape memory characteristics of different shape memory alloy systems, Ti-Ni Phase diagrams

Module 4

Thermally and Magnetically activated Shape memory alloy: constitutive modelling using phenomenological and thermodynamic approaches, its applications as actuator, sensor, energy dissipater, and stent like biomedical items, Design and Application of Shape memory alloys.

Module 5

Magneto rheological fluid: constitutive behaviour and its applications as damper, Behaviour of Electro active polymer and its use as artificial muscles; Properties of Magnetostrictive materials and Optical Fibre.

Text & Reference Books:

1. Mel M. Schwartz, Smart Materials, CRC Press, 2009.
2. Donald J. Leo, Engineering analysis of smart material systems, John Wiley & Sons, 2007.

3. Jiashi Yang, Analysis of piezoelectric devices, World Scientific, 2006.
4. Ralph C. Smith, Smart material systems: model development, siam, 2005.
5. Vijay K. Varadan, Smart material systems and MEMS: design and development methodologies, John Wiley & Sons, 2006.
6. Seung- Bok Choi & Young-Min Han, Piezoelectric actuators: control applications of smart materials, CRC Press - 2010.
7. Antonio Arnau, Piezoelectric transducers and applications, Springer, 2004.

IPPBTP6 MECHATRONICS IN MANUFACTURING SYSTEMS

Course Objectives:

The Objective of this course is

1. Understand characteristics and the components of mechatronics systems
2. Discuss recent trends in Mechatronics
3. Describe active & Passive electrical circuits
4. Describe the techniques are of used to design a mechatronics process.
5. Suggest possible design solutions

Course Outcomes:

On completion of this course, the students will be able to

1. Identification of key elements of mechatronics system and its representation in terms of block diagram
2. Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O
3. Interfacing of Sensors, Actuators using appropriate DAQ micro-controller
4. Time and Frequency domain analysis of system model (for control application)
5. PID control implementation on real time systems
6. Development of PLC ladder programming and implementation of real life system.

COURSE CONTENTS

Module 1

Introduction to Mechatronics, Need of Mechatronics in measurement systems, Control systems, Traditional design.

Module 2

Feedback devices, Introduction of sensors and transducers, Performance terminology, Displacement, Positionand proximity, Velocity and motion, Fluid pressure, Temperature sensors - Light sensors,Selection of sensors, Signal processing, Servo systems.

Module 3

Role of microprocessors in Mechatronics, Introduction of microprocessors and microcontrollers , Pin configuration, Instruction set,Programming of microprocessors using 8085 instructions , Interfacing

input and outputdevices, Interfacing D/A converters and A/D converters , Applications - Temperature control,Stepper motor control, Traffic light controller.

Module 4

Programmable logic controllers(plc), Introduction, Basic structure, Input/output processing, Programming, Mnemonics timers,Internal relays and counters, Data handling, Analog input/output, Selection of PLC.

Module 5

Design and Mechatronics, Designing, Possible design solutions, Case studies of Mechatronics systems.

Text & Reference Books:

1. Histand Michael B. and Alciatore David G., "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.
2. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ, "Mechatronics ", Chapman and Hall, 1993.
3. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications" Wiley Eastern, 1998.
4. Lawrence J.Kamm, "Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics", Prentice-Hall, 2000.
5. Ghosh P.K. and Sridhar, P.R., "Introduction to Microprocessors for Engineers and Scientists, (0000 to 8085)", Second Edition, Prentice Hall, 2004.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Open Elective	**3**	**0**	**0**	**40**	**60**	**100**	**3**
MSPBTO1	**9. Business Analytics**							
IPPBTO2	**10. Industrial Safety**							
IPPBTO3	**11. Operations Research**							
CEPBTO4	**12. Cost Management of Engineering Projects**							
MEPBTO5	**13. Composite Materials**							
CHPBTO6	**14. Waste to Energy**							
ECPBTO7	**15. IoT**							
MCPBTO8	**16. MOOCs**							

MSPBTO1BUSINESS ANALYTICS

Course Objectives:

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 andsolve 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.

Course Outcomes:
On completion of this course, the students will be able to

1. Knowledge of data analytics.
2. Think critically in making decisions based on data and deep analytics.
3. Use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Translate data into clear, actionable insights

COURSE CONTENTS

Module 1
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

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

Module 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.

Module 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.

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

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

Reference:
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.

IPPBTO2 INDUSTRIAL SAFETY

Module1

Industrial safety: Accident, causes, types, results and control, mechanical and electricalhazards, types, causes and preventive steps/procedure, describe salient points of factories act1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire,guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipmentand methods.

Module 2

Fundamentals of maintenance engineering: Definition and aim of maintenanceengineering, 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.

Module 3

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

Module 4

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need andapplications, sequence of fault finding activities, show as decision tree, draw decision tree forproblems in machine tools, hydraulic, pneumatic,automotive, thermal and electricalequipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustionengine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module 5

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, repaircomplexities 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. Aircompressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenanceof mechanical and electrical equipment, advantages of preventive maintenance. Repair cycleconcept and importance

Reference:

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.

IPPBTO3 OPERATIONS RESEARCH

Course Outcomes:

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

1. Apply the dynamic programming to solve problems of discreet and continuous variables.
2. Apply the concept of non-linear programming
3. Carry out sensitivity analysis
4. Model the real world problem and simulate it.

COURSE CONTENTS

Module 1

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

Module 2

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

Module 3

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Module 4

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

Module 5

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

References:

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

CEPBTO4 COST MANAGEMENT OF ENGINEERING PROJECTS

Course Outcomes:

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

1. Discuss the cost concepts in the cost management process.
2. Able to handle the projects by the application of project cost control methods.
3. Determine all types of costing and carryout the analysis of pricings for profitability.
4. Application of PERT/CPM for cost management.

COURSE CONTENTS

Module 1

Introduction and Overview of the Strategic Cost Management Process

Module 2

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunitycost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control;Provision of data for Decision-Making.

Module 3

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 anddocuments 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 Networkdiagram. Project commissioning: mechanical and process

Module 4

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing

andAbsorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-makingproblems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing,Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning,Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-BasedCost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control;

Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitabilitypricing decisions including transfer pricing.

Module 5

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportationproblems, Assignment problems, Simulation, Learning Curve Theory.

References:

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.

MEPBTO5 COMPOSITE MATERIALS

Course outcomes

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

1. Explain and also implement the composite materials for the required performance based on the characteristics.
2. Adopt the composite materials as reinforcements.
3. Implement the methods of manufacturing of metal matrix composites
4. Adopt the methods of manufacturing of polymer matrix composites
5. Evaluate the strength of laminates.

COURSE CONTENTS

Module 1

INTRODUCTION: Definition – Classification and characteristics of Composite materials.

Advantages and application of composites. Functional requirements of reinforcement and matrix. Effectof reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

Module 2

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers,carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particlereinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures.Isostrain and Isostress conditions.

Module 3

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 – Carboncomposites: Knitting, Braiding, Weaving. Properties and applications.

Module 4

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds andprepregs – hand layup method – Autoclave method – Filament winding method – Compressionmoulding – Reaction injection moulding. Properties and applications.

Module 5

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum straincriteria, 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.

References:

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.

CHBTO6 WASTE TO ENERGY

Course outcomes

1. At the end of the course, students will be able to
2. Classify the waste for fuel and identify the devices for conversion of waste to energy.
3. Implement the Biomass Pyrolysis.
4. Evaluate the methods of Biomass Gasification and implement their applications.
5. To design, construct and operation the Biomass Combustion devices.
6. Classify biomass; apply the bio energy systems design and construction.

Module 1

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

Module 2

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

Module 3

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermalheating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration ingasifier operation.

Module 4

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

Module 5

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology andstatus - Bio energy system - Design and constructional features - Biomass resources and theirclassification - Biomass conversion processes - Thermo chemical conversion - Direct combustion -biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion –Typesof biogas Plants – Applications - Alcohol production from biomass - Bio diesel production – Urban wasteto energy conversion - Biomass energy programme in India.

References:

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, TataMcGraw 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.

ECPBTO7 INTERNET OF THINGS (IoT)

Course outcomes

1. At the end of the course, students will be able to
2. Understand the concepts of Internet of Things.
3. Analyze basic protocols in wireless sensor network.
4. Design IoT applications in different domain and be able to analyze their performance
5. Elaborate the need for Data Analytics and Security in IoT.
6. Understand the concepts of Internet of Things.

COURSE CONTENTS

Module 1

Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, sub netting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer. Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardware, Examples of IoT infrastructure.

Module 2

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

Module 3

MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols, IoT Communication Pattern, IoT Protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, Lifi, Widi).

Module 4

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security, Common Challenges in IOT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

Module 5

IoT Physical Devices and Endpoints: Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, and reading input from pins.

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs WebServer: Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API.

IoT application and its Variants: Case studies: IoT for smart cities, smart grid, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0,IoT standards.

References:

- "Internet of Things - A Hands-on Approach", ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
- "Internet of Things",Srinivasa K G, CENGAGE Leaning India, 2017.
- " IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
- "Getting Started with Raspberry Pi", Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
- "From Machine to Machine to Internet of Things", Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, Elsevier Publications, 2014.

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
	Audit Course/Value Added Course	**3**	**0**	**0**	**40**	**60**	**100**	**3**
ELPBTX1	**English for Research Paper Writing**							
PEPBTX2	**Stress Management by Yoga**							
CEPBTX3	**Disaster Management**							
LAPBTX4	**Constitution of India**							

ELPBTX1 ENGLISH FOR RESEARCH PAPER WRITING

Course outcomes:

At the end of the course, 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

COURSE CONTENTS

Module 1

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

Module 2

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

Module 3

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

Module 4

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.

Module 5

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

PEPBTX2STRESS MANAGEMENT BY YOGA

Course Outcomes

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

1. To achieve overall health of body and mind
2. To overcome stress
3. Develop healthy mind in a healthy body thus improving social health also
4. Improve efficiency

Module 1

Definitions of Eight parts of yog. (Ashtanga)

Module 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

Module 3

Asan and Pranayam
i) Various yog poses and their benefits for mind & body
ii)Regularization of breathing techniques and its effects-Types of pranayam

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, AdvaitaAshrama (Publication Department), Kolkata

CEPBTX3 DISASTER MANAGEMENT

Course Outcomes:

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

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reductionand humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practicefrom multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevancein 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.

COURSE CONTENTS

Module 1

Introduction Disaster: Definition, Factors And Significance; Difference Between Hazardand Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Module 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.

Module 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 WithSpecial Reference To Tsunami; Post-Disaster Diseases And Epidemics.

Module 4

Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard;Evaluation Of Risk: Application Of Remote Sensing, Data FromMeteorological And Other Agencies, Media Reports: Governmental andCommunity Preparedness.

Module 5

Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global AndNational Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Module 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, PardeepEt.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.

LAPBTX4 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.

Course Outcomes

At the end of the course, 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.
4. Discuss the passage of the Hindu Code Bill of 1956.

COURSE CONTENTS

- History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working).
- Philosophy of the Indian Constitution: Preamble, Salient Features
- 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.
- 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.
- 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: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy .
- 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.

References:

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

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBPT1	Mini Project	3	0	0	40	60	100	3

IPPBPT1 MINI PROJECT

Course Objectives:

The Objective of this course is

1. To develop design skills according to a Conceive-Design-ImplementOperate (CDIO) compliant methodology.
2. To implement engineering skill and knowledge to complete the identified project work while encouraging creativity and innovation.
3. To develop spirit of team work, communication skills through group-based activity and foster self- directing learning and critical evaluation.

Course Outcomes:

On completion of this course, the students will be able to

1. Identify a problem based on the need analysis of community /industry/ research.
2. Create a flowchart of methodology for solving the identified problem
3. Demonstrate team work with work division, team meetings and communications among team members.
4. Write technical report for the project work and present the same through power point presentations or posters

Course Code	Subjects	Periods/Week			Evaluation			Credits
		L	T	P	IA	ESE	Total	
IPPBLT1	Robotics lab	3	0	0	40	60	100	3

IPPBLT1 ROBOTICS LAB

Course Objectives:

The Objective of this course is

1. Learn about force and torque sensing
2. Learn about application of robot
3. Apply the basic engineering
4. The drive systems used in Industrial applications
5. Simulation Software for Industrial Robots

Course Outcome:

On completion of this course, the students will be able to

At the end of this course, students will demonstrate the ability to

1. Develop Ladder diagrams for PLC Programming
2. Work with simple Automation Systems using PLC
3. Analyze Forward and Inverse Kinematics for Basic Robots
4. Programming and Analysis of Industrial Robots using Software
5. Visualize the configurations of various types of robots.

6. Describe the components of robots like arms, linkages, drive systems and end effectors.

List of Experiments:

(1) Assignment on introduction to robot configuration

(2) Demonstration of robot with 2 dof, 3 dof, 4 dof etc.

(3) Two assignments on programming the robot for applications

(4) Two assignments on programming the robot for applications

(5) Two programming exercises for robots

(6) Two case studies of applications in industry

(7) Exercise on robotic simulation software