

Major Specialization: Manufacturing Engineering							
Mechanical Engineering							
SWAYAM/NPTEL Course List							
Sr. No.	Semester	Name of Course	Teaching Scheme	Duration	Instructor	Organizing Institute	Credits
1	VI	Rapid Manufacturing	4Hrs/week	12 Weeks	Prof. J. Ramkumar, Prof. Amandeep Singh	IIT Kanpur	4
2	V	Manufacturing Systems Technology I & II	4Hrs/week	12 Weeks	Prof. Shantanu Bhattacharya	IIT Kanpur	4
3	VI	Mathematical Modeling Of Manufacturing Processes	4Hrs/week	12 Weeks	Prof. Swarup Bag	IIT Guwahati	4
4	VI	Theory of Production Processes	4Hrs/week	12 Weeks	Prof. Pradeep Kumar Jha	IIT Roorkee	4
5	VII	Production and Operation Management	4Hrs/week	12 Weeks	Prof. Rajat Agrawal	IIT Roorkee	4

## Rapid Manufacturing

By Prof. J. Ramkumar, Prof. Amandeep Singh | IIT Kanpur

### COURSE LAYOUT

Week 1 : Introduction to Rapid Manufacturing (RM)

Week 2 : Product Design Process

Week 3 : Design for Modularity

Week 4 : Reverse Engineering

Week 5 : 3D measurement: laboratory demonstration

Week 6 : Polymerization, and Powder based RM processes

Week 7 : Liquid based, and Sheet stacking RM processes

Week 8 : 3D printing RM processes and laboratory demonstration

Week 9 : Beam Deposition RM processes, and materials in RM

Week 10 : Post-processing and costing in RM

Week 11 : Rapid Product Development (CAD/CAE/CIM)

Week 12 : Rapid Product Development (Software demonstration), and case studies on RM

### BOOKS AND REFERENCES

1. Kamrani, A.K. and Nasr, E.A., 2010. Engineering design and rapid prototyping. Springer Science & Business Media.
2. Gebhardt, A., 2011. Understanding additive manufacturing.
3. Gibson, I., Rosen, D.W. and Stucker, B., 2014. Additive manufacturing technologies (Vol. 17). New York: Springer.
4. Hopkinson, N., Hague, R. and Dickens, P. eds., 2006. Rapid manufacturing: an industrial revolution for the digital age. John Wiley & Sons.
5. Pham, D. and Dimov, S.S., 2012. Rapid manufacturing: the technologies and applications of rapid prototyping and rapid tooling. Springer Science & Business Media.

## Manufacturing Systems Technology I & II

By Prof. Shantanu Bhattacharya | IIT Kanpur

### COURSE LAYOUT

- Week 1 to 3 : Manufacturing properties of materials, Computer aided designing
- Week 4 to 5 : Principles and process planning of basic machining processes, Machine tools design.
- Week 6 : Computer aided process planning
- Week 7 : Introduction to CNC part programming, Product design
- Week 8 : Just-in-time manufacturing
- Week 9 : Quality systems engineering
- Week 10 to 11: Cost of quality and statistical quality control
- Week 12 : Robotic systems planning and designing

### BOOKS AND REFERENCES

Nil

## Mathematical Modeling Of Manufacturing Processes

By Prof. Swarup Bag | IIT Guwahati

### COURSE LAYOUT

Week 1: Introduction to Manufacturing processes

Week 2: Physics of manufacturing processes

Week 3: Conventional machining

Week 4: Non-conventional machining

Week 5: Metal forming

Week 6: Welding

Week 7: Welding

Week 8: Casting and powder metallurgy

Week 9: Coating and additive manufacturing

Week 10: Heat treatment

Week 11: Micro/nano scale manufacturing

Week 12: Processing of non-metallic materials

### BOOKS AND REFERENCES

1. A Ghosh and A K Mallik: Manufacturing Science, East-West Press Pvt Ltd, 2nd Ed., 2010.
2. D A Brandt, J C Warner: Metallurgy Fundamentals, Goodheart- Willcox, 2009.
3. C Lakshmana Rao and Abhijit P Deshpande: Modelling of Engineering Materials, Ane Books Pvt. Ltd., New Delhi, India, 2010.
4. J. Chakrabarty: Theory of plasticity, 3rd Eds, Elsevier India, 2009.
5. Norman Y Zhou: Microjoining and Nanojoining, Woodhead publishing, 2008
6. R W Messler: Principles of Welding John Wiley and Sons, 1999.
7. J T Black and Ronald A Kohser: DeGarmo's Materials & processes in Manufacturing Wiley-India, 2010.
8. V K Jain: Advanced Machining Processes, Allied Publishers, Mumbai, 2002.
9. Yi Qin: Micromanufacturing Engineering and Technology, Elsevier, 2015.
10. J Zhang and Yeon-Gil Jung: Additive Manufacturing: Materials, Processes, Quantifications and Applications, Elsevier, 2018.
11. J A Dantzig and M Rappaz: Solidification, CRS press, 2009.

## Theory of Production Processes

By Prof. Pradeep Kumar Jha | IIT Roorkee

### COURSE LAYOUT

Week 1: Theory of casting and solidification, Fluidity of liquid metals.

Week 2: Technology of patternmaking and mouldmaking, Pattern allowances, Testing of molding sand, cores.

Week 3: Gating system design, Riser Design, different methods of calculating riser volume, Feeding distance calculations.

Week 4: Theory of melting and production of ferrous and non-ferrous materials, Casting design, Casting defects.

Week 5: Mechanical fundamentals of metalworking: Concept of stress and strain, stress and strain tensors, Hydrostatic and deviatoric stresses, Flow curve.

Week 6: Yield criteria for ductile materials, plastic stress strain relationships, classification of metalworking, mechanics of metalworking.

Week 7: Analysis and classification of rolling and forging processes, Force calculations in rolling and forging processes.

Week 8: Analysis and classification of Extrusion process, Analysis of wire, rod and tube drawing processes, Forming defects.

Week 9: Classification of welding processes, Thermal effects in welding, Basic metallurgy of fusion welds, Heat affected zone in welding.

Week 10: Principles of welding processes: Arc welding, Gas metal arc welding, Solid state welding, Resistance welding, Soldering, Brazing and adhesive bonding.

Week 11: Residual stresses in welding, Methods of measurement of residual stresses in welding, Welding distortion and its types, Methods of reducing residual stresses and distortion in welding.

Week 12: Weldability of materials: Introduction and assessment of weldability, Test for weldability, Weldability of ferrous and non-ferrous materials.

### BOOKS AND REFERENCES

1. Ghosh, A., and Mallik, A.K., Manufacturing Science, Affiliated East-West Press Pvt. Ltd.
2. Heine, R.W., Loper, C.R., and Rosenthal, P.C., "Principles of Metal Casting", TMH
3. Dieter George E., "Mechanical Metallurgy", McGrawHill
4. Kuo, S., "Welding Metallurgy", John-Wiley & Sons Inc

## Production and Operation Management

By Prof. Rajat Agrawal | IIT Roorkee

### COURSE LAYOUT

Week 1 : L1 - Introduction to Operations Management;

L2 - Operations Strategy in a global economy ;

L3 - Operations Management and Productivity,

L4 - Types and Characteristics of Manufacturing and Service Systems

L5 - Product Design

Week 2 : L1 - Introduction to Forecasting

L2 - Introduction to Time-series forecasts

L3 - Extrapolative methods I

L4 - Extrapolative methods II

L5- Forecasting Error

Week 3 : L1 - Causal Methods of forecasting

L2 - Qualitative Methods of Forecasting

L3 - Introduction to Inventory Management

L4 - Various costs involved in inventory management

L5 - EOQ Models of Inventory Management

Week 4 : L1 - Various variations of EOQ

L2 - Inventory Models with Uncertain Demand -I

L3 - Inventory Models with Uncertain Demand -II

L4 - Miscellaneous Systems and Issues

L5 - Inventory Control and Supply Chain Management

Week 5 : L1 - Aggregate Sales and Operations Planning

L2 - Aggregate planning Techniques

L3 - Material requirement Planning

L4 - Improvements in the MRP system

L5 - Lot Sizing in MRP Systems

Week 6 : L1 - Nature of Quality

L2 - Evolution of Quality Management

L3 - Modern Quality Management

L4 - Total Quality Management

L5 - Statistical Concepts in Quality Control

Week 7 : L1 - Acceptance Sampling

L2 - 7 QC Tools

L3 - Introduction to Six Sigma

L4 - Quality Function Deployment

L5 - Quality issues in Services

Week 8 : L1- Facility Capacity

L2- Facility Location

L3- Facility Layout I

L4- Line Balancing

L5- Cellular Layout

Week 9 : L1 - Service Facility Layout

L2 - JIT Manufacturing

L3 - Lean Manufacturing

L4 - Kanban Production System

L5 - Case Discussions on JIT and Lean Philosophy

Week 10 : L1 - Maintenance Management

L2 - Total Productive Maintenance

L3 - Introduction to Project Management

L4 - PERT and CPM

L5 - Project Risk Management

Week 11 : L1 - Process Analysis

L2 - Job Design and work Measurement

L3 - Manufacturing Process selection and Design

L4 - Service Process Selection and Design

L5 - Business process Reengineering

Week 12 : L1 - Supply Chain Strategy

L2 - Measuring Supply Chain performance

L3 - Case discussion of Supply Chain Management

L4 - Contemporary Issues in Operations management

L5 - Framework for Operations Strategy Formulation

#### **BOOKS AND REFERENCES**

1. Operations Management by William J. Stevenson
2. Modern Production/ Operations Management by E S Buffa and Rakesh K Sarin
3. Operations Management For Competitive Advantage by Richard B Chase, F Robert Jacobs
4. Operations Management by Norman Gaither and Greg Frazier