

Jabalpur Engineering College, Jabalpur

Semester VII Credit Based Grading System (CBGS) w.e.f. July 2018

Scheme of Examination

Bachelor of Engineering B.E. (Industrial & Production Engineering)

Subject Wise Distribution of Marks and Corresponding Credits

Scheme of Examination w.e.f. July 2018 Academic Session 2018-19

S.No.	Subject Code	Subject Name & Title	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits	Total Marks
			Theory		Quiz, Assignment	Practical			L	T	P		
			End. Sem.	Mid Sem. MST		End Sem.	Lab Work						
1	IP7001	Industrial Robotics & Mechatronics	70	20	10	30	20	3	1	2	6		
2	IP7002	Industrial Engineering	70	20	10	30	20	3	1	2	6		
3	IP7003	Supply Chain & Quality Management	70	20	10	30	20	3	1	2	6		
4	IP7004	Elective-III	70	20	10	-	-	3	1	-	4		
5	IP7005	Elective-IV	70	20	10	-	-	3	1	-	4		
6	IP7006	Project-I	-	-	-	60	40	-	-	4	4		
7	IP7007	Industrial Training (Two Weeks)	-	-	-	30	20	-	-	2	2		
Total			350	100	50	180	120	800	15	5	12	32	800

MST: Minimum of two mid semester tests to be conducted.

L: Lecture T: Tutorial P: Practical

Department Elective-III (Four Subjects)			Department Elective-IV (Four Subjects)		
S.No.	Subject Code	Subject Name	Subject Code	Subject Name	
1	IP7004A	Vibration & Maintenance Engineering	IP7005A	Material Management & Product Design	
2	IP7004B	Project Management	IP7005B	Manufacturing System Design	
3	IP7004C	Automobile Engineering	IP7005C	Product Life Cycle Management	
4	IP7004D	Computer Aided Production Planning	IP7005D	Rapid Prototyping	

Controller (Exam)
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

Registrar (Academic)
for Principal
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

DEAN
Academic
JEC, Jabalpur (M.P.)

Principal
Jabalpur Engineering College
Jabalpur - 482 011 (M.P.)

INDUSTRIAL ROBOTICS AND MECHATRONICS (IP-7001)

Unit I

Introduction to Robotics: Introduction, Definition, Automation and Robotics, Need and importance, basic concepts, Anatomy of Robots, Structure and classification of Robots, Robot configurations, Comparative advantages of different configurations, Resolution, Accuracy, Repeatability.

Unit II

Structure of Robotic System : Robot links, Joints in Robots, Robot Specification, Performance Parameters, Robot Drive Systems, Hydraulic Actuators, Pneumatic Actuators, Electric Drives, Stepper Motors, Comparison of Characteristics of robot Drive Systems, Wrist and Motions, Designs of Gripper Fingers, Gripper Mechanisms, Force Analysis of Gripper Mechanism, Selection Consideration of Gripper.

Unit III

Robot Sensors and Vision: Introduction, Classification of Sensors and their functions, Touch Sensors, Binary Sensors, Analog Sensors, Tactile Sensors, Desirable Features for Sensors and Transducers, Proximity Sensors, Range Sensors, Force and Torque Sensors, Robot Vision, Block Diagram of Vision System, Constructional Features of Vidicon Camera, Analog to Digital Conversion, Image Storage, Image Processing and Analysis, Feature Extraction, Object Recognition.

Unit IV

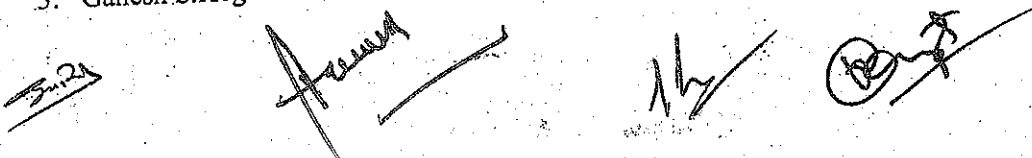
Robot Programming: Introduction, Lead through Programming, Manual, Walk through, off-line Programming Concepts, Requirement of Good Programming Language, VAL Commands with description, Definition and Statements of AL AND AML, Programming Languages features and applications, Program for Pick and Place Activity.

Unit V

Mechatronics: Transducers, Applications and Selection, Application of Proximity Switch, Application of Photoelectric Sensor, Sensor Array, Wrist Sensors, Compliance Sensing, Range Sensing, Guidelines for Selection, Active and Passive Sensors, Basic Requirements of a Sensor/Transducer

Text Books

1. Groover M.P. Weiss M. Industrial Robotics, Tata McGraw Hill Publication.
2. Groover M.P. Cam and Automation, PHI Learning Publishing Ltd.
3. Ganesh S. Hegde. A Text Book on Industrial Robotics. Laxmi Publication.



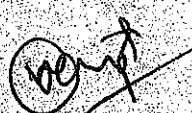
References

1. Ghosal Ashitava. Robotics Fundamental Concepts and Analysis, Oxford Publication.
2. Shimon K. Handbook of Industrial Robots, John Willey & Sons.
3. Fu, Gonzalez, Lee, Robots Control, Sensing, Tata McGraw Hill Publication

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Illustrate the concept of robot and its motion characteristics.
CO2	Identify different types of end effectors and drive systems required for specific applications
CO3	Explain the working of various types of sensors and their applications.
CO4	Develop programming principles and languages for a robot control system
CO5	Understand Application of Proximity Switch, Photoelectric Sensor, Sensor Array, Wrist Sensors

Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.E. Industrial & Production Engineering (VII-Semester) CBGS

Credits: 5 IP-7002

Industrial Engineering

L: 3, T: 1, P: 2

INDUSTRIAL ENGINEERING
(IP-7002)

Unit – I : Reliability Engineering: Introduction and objectives of Reliability Engineering, System Reliability, Achieving Reliability, Failure Rate, Hazard Rate, Failure Modes and the 'Bath-tub' curve, Series Structure, Parallel Structure, Combination Structure, Design, Important Aspect of Reliability, Maintainability, Availability, Improving Reliability.

Unit- II : Capacity Planning: Measurement of Capacity, Estimating Future capacity, Factors influencing effective capacity, Factors Favoring over capacity and under capacity, Business Process Reengineering, Definition, Characteristics of BPR, Need for Re-engineering, Steps in Re-engineering, Process of Re-engineering, Industrial Engineering and Re-engineering, Success factors in reengineering, Advantages of Re-engineering.

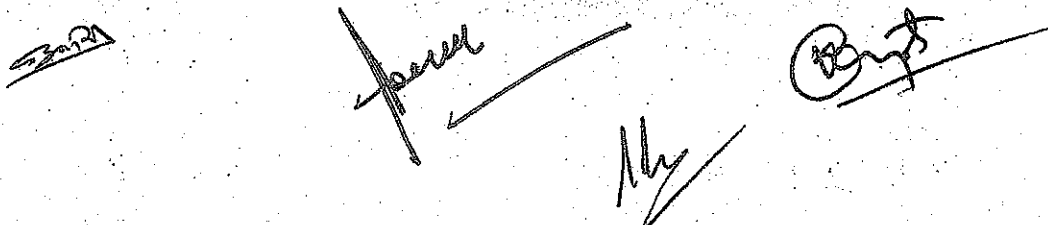
Unit- III : Sequencing Models: Introduction, Assumptions, Gantt chart for Solving Sequencing Problems, Processing n jobs through 2 machines, Johnsons Algorithm, Loading, Sequencing and Scheduling, Visual load Profile, Priority Sequencing, Assignment Problems, Principles of scheduling, Inputs to scheduling, Scheduling strategies, Forward scheduling and backward scheduling, Finite Loading, Critical ratio loading, Index method.

Unit – IV : Marketing Management: Marketing Function, Marketing Management Process and Marketing Planning, Market Research, Consumer Behavior, Product Life Cycle, Product, Product Lines and Brands, Physical Distribution Channels, Sales Promotion & advertising programs.

Unit – V : Human Resource Management: Definition, Objective of Human Resource Management, Characteristics, Functions/Scope, Principles of Human Resource Management, and Manpower Planning – factors Affecting Manpower Planning, Steps in Manpower Planning, recruitment and Selection procedure of Manpower, Training and Development of Manpower: Need of Training, Benefits of Training, Method of Training Workers, Foreman or Supervisory Training, Executive/Managers Training and Development, learning curves and classifications.

Text Books

1. Khanna O. P., "Industrial Engineering and Management", Dhanpat Rai and sons, 2007.
2. Banga T. R. and Sharma S. C., "Industrial Organization & Engineering economics", 23ed., Khanna Publishers, 2001, ISBN 81-7409-078-9.
3. Mahajan M., "Industrial Engineering and Production Management" Dhanpatrai and Sons Publishers, 2005, ISBN-81-7700-047-0
4. Chabra T. N., "Principles & Practices of Management", Dhanpatlal & company.
5. Srinath N., "Reliability Engineering", East West Publication Ltd.



Reference Books

1. Koontz Harold and Weihrich Heinz, "Essentials of management", 7ed, TataMcGraw - Hill publishing, 2008, ISBN 0-07-0623030-x.
2. Luthans f., "Organizational Behaviour", McGraw-Hill Company, 2008, ISBN 81-317- 05021.
3. Kotler Philip & Keller K.L., "Marketing Management. Dorling Kindersley pvt.Ltd.,2008, ISBN- 978-81-317-1683-0
4. Cynthia L.Greene , "Entrepreneurship: Ideas In Action", Thomson, ISBN-981-243-257-1.
5. Mamoria C.B. and Gankar S.V., "Personnel Management", Himalaya Publishing House, 20

INDUSTRIAL ENGINEERING LAB (IP-7002)

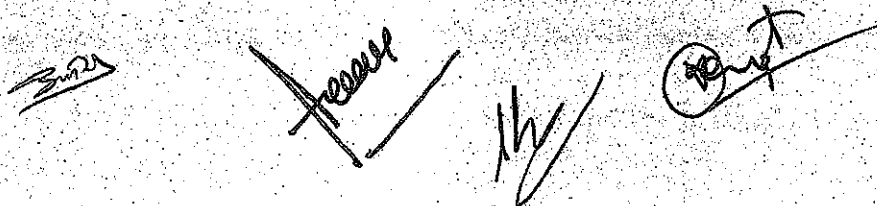
List Of Experiments (Please Expand it):

1. To Study Failure rate and Hazard rate of Component (Industry supported case study).
2. To Construct Gantt Chart for the given Scheduling Problems.
3. Estimate Future capacity of the given plant (Industry supported case study).
4. To find the Training needs of the given plant (Industry supported case study).
5. To study Physical Distribution Channels, Sales Promotion & advertising programs of the given product(Industry supported case study).

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Understand objectives of Reliability Engineering, System Reliability, Achieving Reliability,.
CO2	Estimate Future capacity, understand Factors influencing effective capacity, Factors Favoring over capacity and under capacity
CO3	USE Gantt chart for Solving Sequencing Problems
CO4	Understand Marketing Management Process and Marketing Planning, Market Research



Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.E. Industrial & Production Engineering (VII-Semester) CBGS

Credits: 5 IP-7003

Mechanics of Materials

L: 3, T: 1, P: 2

SUPPLY CHAIN AND QUALITY MANAGEMENT
(IP-7003)

Unit-I : Basic concepts and approach : Introduction, Definition and Concepts of Quality, Quality Evolution, Contribution of Leading Quality Gurus, Deming's Fourteen Points, Dimensions of Quality, Quality Cost, Quality Circle, Key success factors of TQM, PDCA Cycle, PDSA Cycle, Kaizan. Business Process Re-engineering (BPR), Taguchi loss function, cost of quality, 5S Practices, Waste Identification and Reduction, Vendor Rating

Unit -II : Process Control : Seven Quality Control Tools - Process Flow Chart, Histogram, Pareto Diagram, Cause and Effect Diagram, Scatter Diagram, Tally Sheet, Control Charts, Acceptance Sampling, Process Capability Indices, cause-effect, Goalpost and kaizen view of quality, quality of design, conformance and performance; Taguchi loss function, Ishikawa, interrelationship, systematic and matrix diagrams; change concepts and waste elimination
Six Sigma

Concept, Definition, Origin, DMAIC Methodology, Process model for Design of New Product - DMADV Methodology, Six Sigma Implementation, Case study.

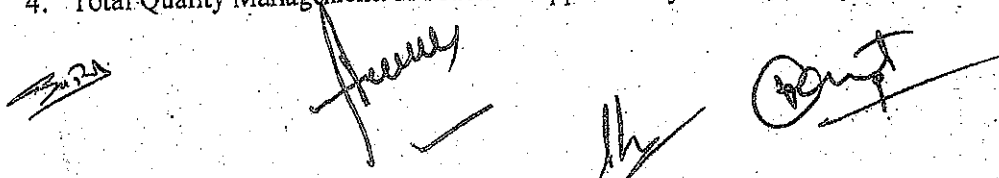
Unit - III : Inventory models : Necessity of inventory in process and safety stock, problem of excess inventory and cycle time ($=WIP/ \text{Throughput}$), JIT/ lean mfg; basic EOQ/ EPQ models for constant review Q-system (S,s); periodic review, base stock P-system; service level, lead time variance and safety stock;; ABC, VED and other analysis based on shelf life, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT;

Unit- IV : Introduction: Logistics and SCM, Definition, Working of SCM, integration of inbound, outbound logistics and manufacturing to SCM; Customer service, Supply chain integration, Bull-whip effect; Impact of centralized demand information; customer value; IT, info-sharing and strategic partnerships; Drivers of SCM

Unit -V: Strategic alliance and integration: Outsourcing benefits and risks; dependency on capacity and knowledge; modular and integral products; framework for make/ buy decision based on dependency and modular/ integral products; issues to be addressed in strategic alliance; use and merit/demerit of third party (3PL) logistic; push, pull and push-pull based supply chains; push-pull boundary, appropriate strategy on matrix of demand uncertainty and economy of scale; coordination and leadership issues; change of purchasing role and vendor rating, variability from multiple suppliers; supply contracts and revenue sharing;

Reference Books:

1. Total Quality Management by Subburai Ramasamy, TMH
2. Total Quality Management by Besterfield, Dale H. et al, Printice Hall
3. Total Quality Management by L. Suganthi and Anand A. Samuel, PHI
4. Total Quality Management: A Practical approach by H. Lal, Wiley, New Delhi



5. Essentials of SCM; Deshmukh & Mohanty; Jaico Publishing House
6. Designing and Managing the Supply Chain; Levi DS & ES, Kaminsky P; TMH
7. Supply Chain Management; Chopra, Meindl, Kalra; Pearson Education
8. Exploring the Supply Chain by Upendra Kachru; Excel Books
9. Supply Chain Management, by Janat Shah; Pearson Education
10. Manufacturing planning and control for SCM; Vollman, Berry et al; TMH.
11. Supply Chain Logisti Mgt; Bowersox DJ, Closs DJ, Cooper MB; TMH
12. World Class SCM; Burt DN, Dobler DW, StarlingSL; TMH

SUPPLY CHAIN AND QUALITY MANAGEMENT LAB (IP-7003)

List Of Experiments (Please Expand it):

1. Case studies and problems related to SCM theory.
2. Construction of Cause & Effect diagram.
3. Construction of Pareto diagram.
4. ABC & VED Analysis.
5. Inventory models for estimating EOQ and EPQ

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Understand the concepts, tools and techniques relating supply chain and quality management.
CO2	Understand the role of logistics in the supply chain within a focal firm as well as between organizations linked within a given supply chain network.
CO3	Determine optimum inventory and cost in inventory models.
CO4	Understand Outsourcing benefits and risks

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Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.E. Industrial & Production Engineering (VII-Semester) CBGS

Credits: 4	IP-7004	Vibration and Maintenance Engineering	L: 3, T: 1, P: 0
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VIBRATIONS AND MAINTENANCE ENGINEERING
(IP-7004)A

Unit - I : Fundamental Aspects of Vibrations : Vibration, main causes, advantages and disadvantages; engineering applications of vibration; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion;; elements of vibratory system; lumped and distributed parameter systems, degree of freedom.

Undamped Free Vibrations: Derivation of differential equation of motion; the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion; Natural frequency of vibration. Equivalent spring stiffness, Systems involving angular oscillations: the compound pendulum.

Unit- II : Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, overdamped and critically damped systems; logarithmic decrement; frequency of damped free vibration; frequency, decay rate, systems with two degrees of freedom.

Whirling Motion and Critical Speed : Whirling motion and Critical speed : Definitions and significance, Critical-speed of a vertical, light -flexible shaft with single-rotor : with and without damping, Free Transverse Vibration due to a Point Load on a Simply Supported Shaft, Free Torsional Vibration of a Single Rotor System.

Unit - III : Maintenance Concepts and Strategies: Introduction, maintenance functions and objectives, maintenance planning and scheduling, maintenance organization.

General Introduction to Maintenance Types: Breakdown, emergency, corrective, predictive, and preventive; maintenance prevention; design-out maintenance, productive maintenance, shutdown maintenance and scheduled maintenance.

Unit - IV : Condition Based Maintenance: Principles of CBM; pillars of condition monitoring, CBM implementation and benefits; condition monitoring techniques- visual monitoring, vibration monitoring, wear debris monitoring, corrosion monitoring, performance monitoring

Unit- V : Reliability Centered Maintenance (RCM): -Concept, methodology, benefits;

Total Productive Maintenance: Evolution of TPM, TPM objectives, concept, pillars of TPM.

Failure Modes and Effects Analysis (FMEA)/ Failure Modes, Effects and Criticality Analysis, (FMECA): Overview, elements of FMECA, applications and benefits, risk evaluation, risk priority numbers, criticality analysis, process FMEA, qualitative and quantitative approach to FMECA; design FMEA and steps for carrying out design FMEA

References:

- 1- Ambekar A.G., Mechanical Vibrations and Noise Engineering; PHI
- 2- Meirovitch Leonard; Element of Vibration Analysis; TMH
- 3- Dukikipati RV Srinivas J Text book of Mechanical Vibrations; PHI
- 4- Kelly SG and kudari SK; Mechanical Vibrations; Schaum Series; TMH
- 5- Thomson , W.T., Theory of Vibration with Applications , C.B.S Pub & distributors .

- 6- Singiresu Rao, Mechanical Vibrations , Pearson Education .
- 7- G.K. Grover, Mechanical Vibration , Nem chand and Bross , Roorkee
- 8- V. P. Singh, Mechanical vibrations, Dhanpat rai and Co.
- 9- Sadhu Singh, Mechanical Vibrations, Khanna Publishers.
- 10- Ebeling CE; An Introduction To Reliability & Maintainability Engg; John Wiley and Sons
- 11- Mishra R.C; Reliability and Maintenance Engineering; New age International publisher.
- 12- Kelly Anthony; Maintenance Planning and Control
- 13- R.C. Mishra and Pathak; Maintenance Engineering and Management; PHI

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Analyze Undamped free vibration systems.
CO2	Analyze Damped free vibration systems.
CO3	Whirling motion and critical speed in Harmonically excited Vibration.
CO4	Analyze condition based maintenance.
CO5	Analyze Reliability Centered Maintenance

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Jabalpur Engineering College, Jabalpur (M.P)
Programme: B.E. Industrial & Production Engineering (VII-Semester) CBGS

Credits: 4 IP-7005 Material Management & Product Design	L: 3, T: 1, P: 0
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MATERIAL MANAGEMENT & PRODUCT DESIGN
(IP-7005) A

Unit-I : Material Management: Introduction to Material Management Functions, objectives, Integration concept Material classification and coding system importance of writing specifications and variety reduction techniques, Material Planning-importance & techniques, Master & material budget, Quality control in material management, Theory of sampling inspection.

Unit-II : Purchasing: Make or buy decision, Factors, Purchasing objectives, organization of purchase department, responsibilities, Principles of purchasing, purchasing process, Tender system, Negotiation, Vendor rating, Legal aspects of purchasing, International purchasing.

Unit-III : Stores management & Material Handling : Introduction, objective of store keeping, stores functions, stores organization, stores systems and procedures, stores accounting and verification systems, stores location and layout, factor affecting location, centralized and decentralized storing, automated/retrieval storage. Planning and operating principles material handling equipments and classification; belt conveyer, chain conveyers, fork lifts, over head cranes, automated material handling in modern industries.

Unit -IV : Product Design: Design by evolution & innovation, factors of product design, morphology of design, Primary design phases & flow charting, design for safety and reliability, value engineering, role of computer in design process

Unit - V : Product design Practice: Product strategies, analysis of the product, basic design considerations, procedure adopted by industrial designers, role of aesthetics, functional design practice, creativity- process, techniques, group technology, concurrent engineering & reverse engineering.

References:

1. Product design & Manufacturing-A.K. Chitale, R. C. Gupta-third edition
2. Purchasing and materials management-Gopalkrishnan P, TMH
3. Materials Management-Chitale AK and Gupta RC, PHI

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Course Outcomes:

At the completion of this course, students should be able to-

CO1	Understand objectives and Integration concept of material managment
CO2	Understand Purchasing objectives Principles of purchasing, purchasing process
CO3	Understand store managment, stores functions, stores organization, stores systems and procedures.
CO4	Understand product design and morphology of design