<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject</th>
<th>No. of Hrs./Week</th>
<th>Duration of the Exam in Hours</th>
<th>Marks for</th>
<th>Total Marks</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>16MPE31</td>
<td>Seminar / Presentation on Internship (After 8 weeks from the date of commencement)</td>
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<td>16MPE32</td>
<td>Report on Internship</td>
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<td>16MPE33</td>
<td>Evaluation and Viva-voce of Internship</td>
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<td>16MPE34</td>
<td>Evaluation of Project Phase 1</td>
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## VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
### SCHEME OF TEACHING AND EXAMINATION FOR
#### M.TECH.-PRODUCTION ENGINEERING (MPE)

### IV Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>No. of Hrs./Week</th>
<th>Duration of Exam in Hours</th>
<th>Marks for</th>
<th>Total Marks</th>
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<tbody>
<tr>
<td>16MPE41</td>
<td>Maintenance Engineering &amp; Management</td>
<td>Lecture 4, Field Work / Assignment / Tutorials 2</td>
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<tr>
<td>16MPE42X</td>
<td>Elective-III</td>
<td>Lecture 3, Field Work / Assignment / Tutorials 1</td>
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<td>16MPE43</td>
<td>Evaluation of Project Phase-II</td>
<td>Lecture 2, Field Work / Assignment / Tutorials 2</td>
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<td>16MPE44</td>
<td>Evaluation of Project Work and Viva-voce</td>
<td>Lecture 2, Field Work / Assignment / Tutorials 2</td>
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<td>Lecture 7, Field Work / Assignment / Tutorials 6</td>
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### Elective - III

<table>
<thead>
<tr>
<th>Sub. Code</th>
<th>Name of the Subject</th>
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<tbody>
<tr>
<td>14 MPE 421</td>
<td>Industrial Design &amp; Ergonomics</td>
</tr>
<tr>
<td>14 MPE 422</td>
<td>Smart Materials &amp; Structures</td>
</tr>
<tr>
<td>14 MPE 423</td>
<td>Rapid Prototyping</td>
</tr>
<tr>
<td>14 MPE 425</td>
<td>Advanced Manufacturing Practices</td>
</tr>
</tbody>
</table>
Note:

1) Project Phase – I: 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carry out literature survey / visit to Industries to finalise the topic of dissertation.

2) Project Phase – II: 16 weeks duration during 4 semester. Evaluation shall be done by the committee constituted comprising of HOD as Chairman, Guide and senior faculty of the Department.

3) Project Evaluation: Evaluation shall be taken up at the end of 4 semester. Project work and evaluation and Viva Voce examination shall be conducted.
   
   a. Internal Examiner shall carry out the evaluation for 100 marks
   b. External Examiner shall carry out the evaluation for 100 marks.
   c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
   d. Viva-Voce examination of project work shall be conducted jointly by Internal and External examiner for 100 marks.
IV SEMESTER

MAINTENANCE ENGINEERING & MANAGEMENT

<table>
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<tr>
<th>Subject Code</th>
<th>IA Marks</th>
<th>No. of Lecture Hours/Week</th>
<th>Exam Hours</th>
<th>Total No. of Lecture Hours</th>
<th>Exam Marks</th>
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<tr>
<td>16MPE41</td>
<td>20</td>
<td>04</td>
<td>03</td>
<td>50</td>
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</tr>
</tbody>
</table>

MODULE 1
Failure Statistics: Breakdown time distributions, Poisson, Exponential and Normal Distributions.

MODULE 2
Maintenance Planning: Overhaul and Repair: Meaning and Difference, optimal overhaul/Repair/Replace maintenance policy for equipment subject to breakdown.

MODULE 3
Replacement Decisions: Optimal interval between preventive replacements of equipment subject to breakdown, group replacement.

MODULE 4
Maintenance Systems: Fixed Time Maintenance, Condition based Maintenance, Operate to Failure, opportunity maintenance, Design out maintenance, total productive maintenance.

MODULE 5
Inspection Decision: Optimal Inspection frequency, (for maximization of profit and minimization of downtime), Non-destructive Inspection, Lubrication program development, CPM and PERT in maintenance.


TEXT BOOKS:

REFERENCE BOOKS
MODULE 1
Introduction: An approach to industrial design - elements of design structure for industrial design in engineering application in modern manufacturing systems.

Ergonomics and Industrial Design: Introduction - general approach to the man-machine relationship – workstation design-working position.

MODULE 2
Control and Displays: shapes and sizes of various controls and displays - multiple displays and control situations - design of major controls in automobiles, machine tools etc., - design of furniture design of instruments.

MODULE 3
Ergonomics and Production: Ergonomics and product design ergonomics in automated systems - expert systems for ergonomic design, Anthropomorphic data and its applications in ergonomic design limitations of anthropomorphic data - use of computerized database.

MODULE 4
Visual Effects of Line and Form: The mechanics of seeing psychology of seeing, general influences of lined and form.

Colour: colour and light - colour and objects - colour and the eye colour consistency - colour terms - reactions to colour and colour continuation - colour on engineering equipments.

MODULE 5
Aesthetic Concepts: Concept of unity - concept of order with variety - concept of purpose style and environment - Aesthetic expressions. Style-components of style - house style, observations style in capital goods.

Industrial Design in Practice: General design - specifying design equipments - rating the importance of industrial design – industrial design in the design process.

TEXT BOOKS:

MODULE 1
Overview of Smart Materials, Structures and Products Technologies.


MODULE 2
Smart Sensor, Actuator and Transducer Technologies:
Smart Sensors: Accelerometers; Force Sensors; Load Cells; Torque Sensors; Pressure Sensors; Microphones; Impact Hammers; MEMS Sensors; Sensor Arrays Smart Actuators: Displacement Actuators; Force Actuators; Power Actuators; Vibration Dampers; Shakers; Fluidic Pumps; Motors Smart Transducers: Ultrasonic Transducers; Sonic Transducers.

MODULE 3
Measurement, Signal Processing, Drive and control Techniques
Quasi-Static and Dynamic Measurement Methods; Signal Conditioning Devices; Constant Voltage, Constant Current and Pulse Drive Methods; Calibration Methods; Structural Dynamics and Identification Techniques; Passive, Semi-Active and Active Control; Feedback and Feed forward Control Strategies.

MODULE 4
Design, Analysis, Manufacturing: Case studies incorporating design, analysis, manufacturing and application issues involved in integrating smart materials and devices with signal processing and control capabilities to engineering smart structures and products.

MODULE 5
Applications of Engineering Smart Structures and Products
Emphasis on structures, automation and precision manufacturing equipment, automotives, consumer products, sporting products, computer and telecommunications products, as well as medical and dental tools and equipment.

TEXT BOOKS:

REFERENCE BOOKS:
RAPID PROTOTYPING

Subject Code: 16M PE 423  
IA Marks: 20

No. of Lecture Hours/Week: 03  
Exam Hours: 03

Total No. of Lecture Hours: 40  
Exam Marks: 80

MODULE 1
Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.


MODULE 2


MODULE 3

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.

MODULE 4
Rapid Tooling: Indirect Rapid tooling -Silicone rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirkite, 3Q keltool, etc >Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMLS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

MODULE 5

TEXT BOOKS:

REFERENCE BOOKS:
ADVANCED MANUFACTURING PRACTICES

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>IA Marks</th>
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<td>16 MPE424</td>
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<tbody>
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<table>
<thead>
<tr>
<th>Total No. of Lecture Hours</th>
<th>Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>80</td>
</tr>
</tbody>
</table>

**MODULE 1**

Need of CPC for a company, what CPC can do, CPC-getting the right tool.

JIT - Introduction – The spread of JIT Movement, some definitions of JIT, core Japanese practices of JIT, Creating continuous Flow Manufacture, Enabling JIT to occur, Basic elements of JIT, Benefits of JIT.

Just in Time Production – Primary purpose, profit through cost reduction, Elimination of over production, Quality control, Quality Assurance, Respect for Humanity, Flexible work Force, JIT Production Adapting to changing production Quantities, process layout for shortened lead Times, Standardization of operation, Automation.

Sequence and Scheduling Used by Suppliers: Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system to sub contractors.

**MODULE 2**

Toyota Production System-The philosophy of TPS, Basic Frame work of TPS, Kanbans. Determining the Number of Kanbans in Toyota Production System.

a) Kanban Number under Constant Quantity Withdrawal System.

b) Constant Cycle, Non-constant Quantity Withdrawal System.

Supplier Kanban and the Sequence Schedule for Use by Suppliers.

a) Later Replenishment System by Kanban.

b) Sequenced Withdrawal System.

c) Circulation of the Supplier Kanban within Toyota.

Production Smoothing in TPS

Production Planning

Production Smoothing

Adaptability to Demand Fluctuations

Sequencing Method for the Mixed Model Assembly Line to Realize Smoothed Production of Goal.

**MODULE 3**

Just-in-Time Production with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept.

**MODULE 4**

Total Quality Control-Introduction-Total Quality Control concepts, responsibility, learning from the west, TQC concepts categorized, Goals, Habit of improvement, perfection, Basics, process control, Easy to see Quality control as facilitator, small lot sizes, Housekeeping. Less than full capacity scheduling, Daily machine checking, Techniques and Aids, Exposure of problems, Fool proof Devices, Tools of Analysis, QC Circles, TQC in Japanese-owned US Electronics plant, TQC in Japanese-owned Automotive plants.
MODULE 5
Plant Configurations: Introduction—ultimate plant configuration, job shop Fabrication, Frame Welding, Forming Frame parts from Tubing, Dedicated production lines, overlapped production, the daily schedule, Forward Linkage by means of Kanban, physical merger of processes, Adjacency, mixed Models, Automated production Lines, Pseudo Robots, Robots, CAD and Manufacturing, Conveyors and stacker Cranes, Automatic Quality Monitoring

TEXT BOOKS:

REFERENCE BOOKS:
1. An Integrated Approach To Just In Time - Yasuhiro Monden - Toyota Production system.