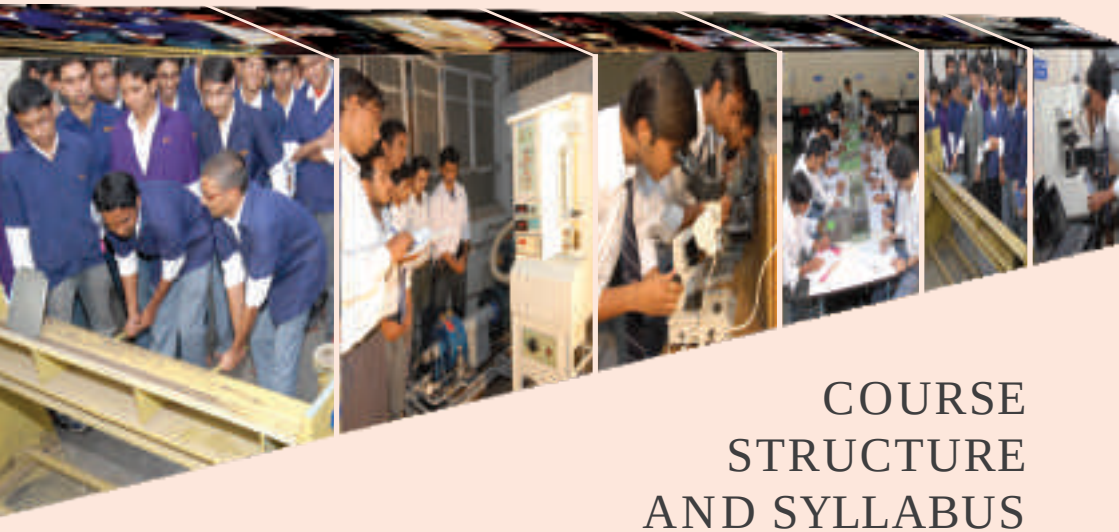
# BHARATI VIDYAPEETH UNIVERSITY,
# Pune.

(Established under Section 3 of UGC ACT 1956)



# COURSE STRUCTURE AND SYLLABUS

B. Tech. (PRODUCTION) (Sem. V & VI)

# COURSE STRUCTURE & SYLLABUS

BHARATI VIDYAPEETH UNIVERSITY, PUNE

B. Tech. (PRODUCTION) (Sem. V & VI)

# HIGHLIGHTS

Bharati Vidyapeeth University College of Engineering (BVUCOE) is the largest Engineering College in Maharashtra with an intake of 700 students in each academic year. Imparting quality technical education from undergraduate to doctorate Level, BVUCOE is probably the only Engineering College in India with an accreditation from both NAAC as well as NBA. The faculty at BVUCOE boasts of highly qualified academicians, a quality that is further emphasized by the fact that 15 of them are presently pursuing their Ph.D. degree.

BVUCOE has been ranked 29th amongst the Top 50 Technical Schools of India in survey conducted by DATAQUEST-IDC. We have enjoyed a ranking in this list for the last 4 years. Research is of utmost importance in all our programs. A total of 113 research papers were published in 2007-2008.

Currently we have 12 ongoing research projects. The infrastructure of BVUCOE is state-of-the-art with 62 classrooms, 59 laboratories and a well-stocked library that currently holds 27,130 titles. The college has an international presence with MOUs signed with the North Carolina A&T State University (Greensboro, USA), University of Venice (Italy), Actel Corporation (USA). Corporate interaction is also inculcated in our programs through our association with Oracle India Ltd., Infosys Ltd. and Tata Consultancy Services.

## SALIENT FEATURES

Production Engineering Department was established in the year 1983. This is one of few departments to be established in the University of Pune, to which this college was affiliated from 1983 to 2000.

The department is trying to give best of academic & practical knowledge to students right from the inception. The departmental goals are:

- Provide Students with a balance of intellectual and practical experiences that enable them to address society needs.
- Quality improvement of staff and students for value added education.
- Identifying emerging technologies and Design innovate methods for teaching and learning.
- Project topics to focus on industrial needs and contribute to economic and social development.
- Ensure the highest quality of teaching and learning, led by active research.
- Promote Industry-Institute Interaction.

The workshop is the part of Production Engineering Department and it is having 2134 sq.mts area with different facilities spread over three floor.

- Basement: Machine Shop, Moulding Shop and Black Smithy.
- Ground Floor: Production Shop, Turning Shop, Welding Shop, Advanced Manufacturing Shop.
- First Floor: Pattern Making Shop, Carpentry Shop, Tin Smithy Shop, Plumbing Shop, FittingShop, Plastic Moulding Shop. The department spreads over a built up area of 3068 sq.mts.

### MAJOR GROUPS/AREAS

Manufacturing Processes, Advance Productivity Techniques, Industrial Engineering, Metallurgy, Manufacturing Automation, CAD/CAM, Product Design, Inspection ad Testing.

### EXPERTISE IN RESEARCH AND CONSULTANCY

Production Engineering Department has received grant of Rs. Five Lakhs from All India Council for Technical Education (AICTE), New Delhi for development of Non-Traditional Machining Processes Laboratory under MODROBS Scheme. Also a DST

Project of 18 Lakhs has been received for further research in Non-Traditional Machining processes laboratory.

One of the faculty member has completed Ph.D programme at Indian - Institute of Technology, Kanpur under Quality - Improvement programme (QIP) and one staff member is pursuing Ph.D programme in U.S.A. Two staff members are pursuing Ph.D programme in Bharati Vidyapeeth University.

Our metallurgy lab has all the facilities required for inspection and testing of materials.

MAJOR EQUIPMENTS

CNC Lathe, CNC lathe trainer, Spark erosion machine, Optical micrometer with CCTV, Vickers cum Brinell Hardness Tester, Ultrasonic Flaw Detector, Magnetic Particle Tester, Spark Erosion Machine, Electro-Chemical Machine, Surface Roughness Tester (Mitutoyo Make).

SOFTWARES

Ideas 10 NX and CATIA V-5 R-ll. Proe Wild Fire is licensed for 50 users.

LABORATORIES

Metallurgy Laboratory, Metrology and Quality Control Laboratory, CAD/CAM Laboratory, Non-Traditional Machining Processes Laboratory, Cutting Tool Engg. Laboratory.

## B. Tech. - PRODUCTION

### Semester V

Total Duration : 32 Hrs / Week
Total Marks : 750

| Subject Code | Subject | Teaching Scheme Hrs / Week | | | Examination Scheme | | | | Total (marks) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | P | D | Theory | Unit Test | TW & Pr | TW & Or | |
| K60321 | Engineering Metallurgy | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K60322 | Kinematics & Design of Manufacturing Machines | 04 | - | 02 | 80 | 20 | - | 50 | 150 |
| K60323 | Metal Forming | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K60324 | Database & Information Technology | 04 | - | - | 80 | 20 | - | - | 100 |
| K60325 | Technology of Metal Cutting | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K60326 | Production Practice - II | - | 02 | - | - | - | 50 | - | 50 |
| | Total | 20 | 08 | 02 | 400 | 100 | 50 | 200 | 750 |

| Teaching Scheme | | | Examination Scheme | | | | Total |
|---|---|---|---|---|---|---|---|
| Lectures | Practical | Drawing | Theory | Unit Test | T. W. & Pr | T. W. & Or | |
| 20 | 08 | 02 | 400 | 100 | 50 | 200 | 750 |

### Semester VI

Total Duration : 32 Hrs / Week
Total Marks : 750

| Subject Code | Subject | Teaching Scheme Hrs / Week | | | Examination Scheme | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | L | P | D | Theory | Unit Test | TW & Pr | TW & Or | |
| K60327 | Advanced Manufacturing Systems | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K60328 | Fluid Mechanics & Machine Tool Control System | 04 | 02 | - | 80 | 20 | - | 50 | 150 |
| K60329 | Metrology & Quality Control # | 04 | 02 | - | 80 | 20 | 50 | - | 150 |
| K60330 | Jig Fixture & Die Design* | 04 | - | 02 | 80 | 20 | - | 50 | 150 |
| K60331 | Production Planning & Control | 04 | - | - | 80 | 20 | - | - | 100 |
| K60332 | Production Practice – III | - | 04 | - | - | - | 50 | - | 50 |
| | Total | 20 | 10 | 02 | 400 | 100 | 100 | 150 | 750 |

| Teaching Scheme | | | Examination Scheme | | | | Total |
|---|---|---|---|---|---|---|---|
| Lectures | Practical | Drawing | Theory | Unit Test | T. W. & Pr | T. W. & Or | |
| 20 | 10 | 02 | 400 | 100 | 100 | 150 | 750 |

* Theory Paper will be of 4 Hrs., # Subject common to Mechanical Branch

# RULES FOR CONDUCTING TESTS

Mode of the test

- In each semester for each subject three tests shall be conducted. The schedule for the same will be declared at the commencement of academic year in the academic calendar.
- Each test shall carry 20 marks.
- University examination pattern has given weightage of 20 marks for the tests.
- To calculate these marks following procedure is followed:

  i) Out of the three tests conducted during the semester, the marks of only two tests in which the candidate has shown his / her best performance shall be considered, to decide the provisional marks in each subject.

  ii) Average marks obtained in two tests in which students have performed well, shall be considered as provisional marks obtained by the student in the tests.

  iii) If the candidate appears only for two tests conducted during the semester, he / she will not be given benefit of the best performance in the tests.

  iv) If the candidate appears only for one test conducted during the semester, to calculate the marks obtained in the tests it will be considered that the candidate has got 0 (zero) marks in other tests.

  v) The provisional marks obtained by the candidate in class tests should reflect as proportional to theory marks. In cases of disparity of more than 15% it will be scaled down accordingly; These marks will be final marks obtained by the student. No scaling up is permitted.

  vi) If the candidate is absent for theory examination or fails in theory examination his final marks for tests of that subject will not be declared. After the candidate clears the theory, the provisional marks will be finalized as above.

- Paper Pattern for Tests

  i) All questions will be compulsory with weightage as following

  | | | |
  |---|---|---|
  | Question 1 | - | 7 marks |
  | Question 2 | - | 7 marks |
  | Question 3 | - | 6 Marks |

  ii) There will not be any sub-questions.

- For granting the term it is mandatory to appear for all the three tests conducted in each semester.
- Roll numbers allotted to the students shall be the examination numbers for the tests.

# SEMESTER - V

# K60321: ENGINEERING METALLURGY

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Practical | : 02 Hrs / Week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

Unit-I (08 Hours)

Introduction to Ferrous & Non-ferrous Metallurgy:

Study of ferrous metals & non-ferrous metals, Brief idea about iron & steel making, blast furnace, sponge iron, cast irons, Wrought irons, pig iron, Study of metallography & microscopes, Etching methods, macroscopic examination methods. Study of Iron-Iron carbide equilibrium diagram, different types of reactions & phases, critical temperatures, cooling of different steels, Classification & specifications of steels, Structure – property relationship, microstructures of plain carbon steels, Measurement of grain size.

Unit-II (10 Hours)

Heat Treatment of Steels:

Transformation products of austenite, Martensite transformation & characteristics of martensite, Time – Temperature Transformation curve, Critical Cooling rate, Heat treatment of steels - Annealing, Normalizing, Hardening, Hardenability, Martempering, Austempering, Retained austenite, Tempering, Ausforming, Secondary hardening, Quench cracks.

Unit-III (06 Hours)

Surface Treatments and Coating Process:

Necessity of surface hardening, Carburizing & its types, nitriding & its types, Carbonitriding, Tuffriding, Flame & Induction hardening, Laser hardening, Heat treatment furnaces, Atmospheres used in heat treatment, Defects in heat treatments.

Unit-IV (10 Hours)

Alloy Steels & Tool Steels:

Classification of alloying elements, Effect of alloying elements on

properties, Various alloy steels, Stainless steels – Classification, Applications & properties, Tool Steels – Classification, Applications & properties, heat treatment of tool steels, mold tool steel.

Unit-V (08 Hours)

Cast Irons:

Classification of Cast irons, Muler's diagram, effect of cooling rate and alloying elements on cast irons, Types of cast irons, alloy cast irons, Manufacturing methods, Properties, applications of each cast irons, Alloy cast irons, Comparison of steels & cast irons, Heat treatments of cast irons.

Unit-VI (08 Hours)

Study of Non-ferrous Metals and Alloys:

Study of copper and it's alloys, equilibrium diagram of Cu-Zn system, Brasses, Bronzes, Study of Aluminum and its alloys, Al-Si equilibrium diagram, applications and properties of non ferrous alloys, Nickel and magnesium alloys, Materials for Bearings.

Termwork

List of Experiments: (Any Eight)

- Study of metallurgical microscope and etching technique
- Specimen preparation for metallography
- Macroscopic examination tests
- Study of plain carbon steels and its microstructures
- Study of cast irons and its microstructures
- Study of Non ferrous metals and its microstructures
- Heat treatment for plain carbon steels
- Jomeny End Quench test for hard ability measurements
- Any one surface Harding Heat treatment

Oral

Term work and oral will be based on above syllabus.

Text Books / References


- Dr. V. D. Kodgere, "Material Science and Physical Metallurgy", Everest Publication, Pune
- Vijendra Singh, "Physical Metallurgy", Standard Publishers Distributors, Delhi
- S. H. Avner, "Physical Metallurgy", Tata Micro hill Publication , Delhi
- R K Rajput , "Heat Treatments of Metals", S. K. Kataria and Sons Publication, Delhi
- T. V. Rajan, C. P. Sharma and Ashok Sharma, "Heat Treatment Principals and Techniquies", PHI Publication, New Delhi


Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & II |
| Unit Test 2 | Units III & IV |
| Unit Test 3 | Units V & VI |

# K60322: KINEMATICS & DESIGN OF MANUFACTURING MACHINES

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Drawing | : 02 Hrs / Week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

Unit-I (08 Hours)

Computer Aided Analysis and Synthesis of mechanisms and kinematics structure of machine tools:

Computer Aided Analysis and coupler curves for four bar mechanism and slider crank mechanism, dimensional synthesis of mechanisms, three position synthesis of slider crank mechanism, Over lay method, Bloch Synthesis, Least square technique, Machine tool motion and their transmissions, Kinematic balancing equation for motion transmitting elements, Kinematic analysis of machine tool structure: gear hobbling, gear shaping, bevel gear generator.

Unit-II (08 Hours)

Spur Gears:

Various design considerations, Beam Strength, tangential loading, module Calculations, width calculations, types of gear tooth failures, Estimation of dynamic load by velocity factor and Spott's equation.

Helical Gears:

Normal Module, Virtual no. of teeth, force analysis, Beam and wear. strength, Introduction to Design of Helical Gears.

Unit-III (08 Hours)

Design for Manufacture:

General Principles for Design for Manufacture, Principles of design for casting, Forging, Machining, Welded Joints, etc., Design for Manufacturing & Assembly.

Product Design:

Aesthetics: Aim, basic forms of elements, contribution of factors like structure, elegance, rhythm, proportions, harmony, use of curves, joints, materials, surface finish & colour.

Ergonomics: Aim, man-machine relationship, use of anthropometrical data related with machine tool & control elements, design of controls & display.

Unit-IV (08 Hours)

Friction & Lubrication:

Dry friction, friction between screw and nut, friction in turning pairs, friction circle and friction axis, friction in mechanism, principles of thick and thin film lubrication methods, principles of hydrodynamic and hydrostatic lubrication.

Unit-V (10 Hours)

Fundamental of Vibration:

a) Un-damped Free Vibration, Equilibrium method, Energy method, Rayleighs method.

b) Damped Free Vibrations of single degree freedom system, types of damping, free vibration with viscous damping, over damped system, critically damped system, under-damped system, logarithmic decrement, viscous dampers, dry friction or coulomb damping, frequency of damped oscillations.

c) Forced Vibration of single Degree of freedom systems, vibration isolation and transmissibility, force transmissibility, Motion transmissibility, Vibration measuring instrument, measurement of displacement, velocity, acceleration, frequency and damping of vibrating systems, vibration analysis using FFT analyzer.

Unit-VI (08 Hours)

Statistical considerations in Design and Optimum Design:

Statistical Considerations in Design: Analysis of Tolerances, Design and Natural Tolerances, Factor of safety and reliability.

Optimum Design: Objectives of Johnson's Method of optimum design, design for normal specification and redundant and incompatible specification, Lagrange multipliers.

Termwork

- Assignments- One on each Unit

Oral

Based on above term work.

Text Books / References

- Bhandari V.B., "Design of Machine Elements", Tata McGraw Hill Publication
- Shigly, "Mechanical Engineering Design",Tata McGraw Hill Publication
- M. F. Spott, "Design of Machine Elements", Prentice Hall
- Thomas Bevan, "Theory of Machines", CBS Publisher & Distributors
- J. E. Shigley, "Theory of Machines & Mechanisms", McGraw Hill Publication
- P L Ballaney, "Theory of machines", Khanna Publishing, New Delhi
- R S Khurmi, J. K. Gupta, "Theory of Machines", E P H
- G. K. Groover, "Mechanical Vibrations"
- Sen & Bhattacharya, "Machine Tool Design"
- Phakatkar, "Theory of Machine-II"

Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & II |
| Unit Test 2 | Units III & IV |
| Unit Test 3 | Units V & VI |

# K60323: METAL FORMING

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Practical | : 02 Hrs / Week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

Unit-I (08 Hours)

Fundamentals of Material Forming:

Introduction of forming processes. Concept of Formability, formability limits and formability diagram.

Wire and Tube Drawing:

Introduction rod and wire drawing machines - construction and working. Preparation of stock for wire drawing. Wire drawing dies, material and design. Heat treatment, variables in wire drawing, Maximum reduction in wire in one pass, forces required in drawing. Multiple drawing, work hardening, lubrication in wire drawing.

Tube drawing: Methods, force calculation , stock penetration. lubrication in tube drawing.

Unit-II (08 Hours)

Forging:

Introduction, classification of forging processes. Forging equipment- Hammers, presses, furnaces etc. construction working capacities and selection of equipment. Basic forging operations such as drawing, fullering edging, blocking etc. Forgability tests, design of forging as a product, friction in forging. Forging defects and the remedies. New technologies: Liquid metal forging, Isothermal forging, No draft forging, P / M forging, Rotary swaging, Roll forging, lubrication in forging.

Unit-III (08 Hours)

Rolling of Metals:

Scope and importance of rolling. Types of Rolling Mills- construction and working. Roll bite, reduction, elongation and spread. Deformation in rolling and determination forces required. Process variables, redundant deformation. Roll flattening, Roll camber - its effect on rolling process, mill spring. Defects in rolling. Automatic gauge control- Roll pass classification

& design. Lubrication in rolling.

Unit-IV (10 Hours)

Sheet Metal Working:

Sheet Metal properties, gauges and surface conditions.

Study of presses and equipments used, various cutting and forming operations, types of dies used, force requirement, theory of shear, methods of force reduction, defects, lubricants used.

Miscellaneous sheet metal working operations: Metal spinning, fine blanking, coining, embossing, rubber forming, stretch forming.

Design of Press Tools:

General classification and components of press tools, types of dies- simple, compound, combination dies, various press working operations such as punching, blanking, deep drawing, bending, forming etc.

Design and calculations for above press working dies.

Unit-V (06 Hours)

Plastics Processing:

Materials used for plastic processing, Compression, transfer, injection & Blow Moulding processes - its working, construction & types.

Unit-VI (10 Hours)

Extrusion:

Types: Direct, reverse, impact, hydrostatic extrusion. Dies for extrusion, stock penetration. Extrusion ratio of force equipment (with and without friction), metal flow in extrusion, defects. Role of friction and lubricants. Manufacture of seam-less tubes.

Advanced Metal Forming Processes:

High velocity forming- principles, comparison of high velocity and conventional forming processes. Explosive forming, Magnetic pulse forming, Electro hydraulic forming. Stretch forming, Coining Embossing, Curling, Spinning, Flow forming advantages, limitations and application of the process.

Term Work

Term work shall consist of

- Assignment based on each topic of syllabus
- Design & working drawing of simple blanking die.
- Design & working drawing of progressive / compound / combination die.
- Design & working drawing of a deep drawing die.
- A report on factory visit, comprising of product range, processes, plant layout. AuxilIary equipment, process parameters etc.

Oral

Oral will be based on Termwork and above syllabus.

Text Books / References


- Dieter, "Mechanical Metallurgy"
- P. N. Rao, "Manufacturing Technology", Tata McGraw Hill
- G.W. Rowe, "Principles of Industrial Metal Working Process", Edward Arnold
- Dr. R. Narayanswamy, "Metal Forming Technology", Ahuja Book Co.
- Surender Kumar, "Principles of Metal Working"
- "ASM Metal hand book Vol: 4 forming"
- P.C.Sharma, "Production Engineering", S. Chand
- Masleror and Berkvasky, "Theory of Plastic Deformation and Metal Working", MIR Publications
- J. N. Harris, "Mechanical Working of Metals", Pergmon Press
- Aviter, "Fundamental of Metal Working", McGraw Hill Publisher
- Schilles, "Press Working"
- R.G.W. Pye; "Injection Moulding", EWP.

Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & II |
| Unit Test 2 | Units III & IV |
| Unit Test 3 | Units V & VI |

# K60324: DATABASE AND INFORMATION TECHNOLOGY

TEACHING SCHEME
Lectures : 04 Hrs / Week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

---

Unit-I (08 Hours)

Database System Concepts, Architecture ER Diagram:

Data models ,schemas and instances, Three schema architecture. Database languages and interfaces. the database system environment ,Centralized and client server architecture used for DBMS. Data modeling using the entity –relationship model. ER diagram.

Unit-II (08 Hours)

Information Technology:

Knowledge based system introduction, Knowledge representation-rule based, logic based, object oriented, semantic nets, frames, neural nets. Inference mechanism forward and backward chaining. Knowledge acquisition, coding, expert system shells.

Unit-III (08 Hours)

Information Technology Application

Selected application of information technology application in manufacturing

1. Product design
2. Process planning and scheduling
3. Robot movement
4. Factory layout
5. Diagnostic maintenance
6. Quality Control
7. Artifical application

Unit-IV (08 Hours)

Computational Technique –I:

Roots of equation

a. Bracketing methods-Bisection and false position method.
b. Open methods-simple fixed point iteration and Newton –Raphson method.
c. Linear algebric equation-Narie Gauss Elimination, Gauss-Jordon and Gauss Siedel method.

Unit-V (08 Hours)

Computational Technique-II:

Least square regression –Linear regression ,polynomial regression and multiple linear regression.

Interpolation:

Newtons divided difference interpolating polynomials, Lagranges interpolating polynomial, inverse interpolation.

Unit-VI (08 Hours)

Computational Technique-III:

Newton cotes integration –The trapezoidal rule, Simson's rule, Romberg integration, Gauss Quadrature Numerical differentiation–Differentiation formula, Richardson extrapolation ,derivatives of unequally spaced data.

Text Books / References


- Kerr R., "Knowledge Based Manufacturing Management", Addision Wiley, 1991
- Addis T. R., "Designing Knowledge Based System", Prentice Hall 1985
- Roltson D. W., "Principles of Artificial Intelligence and Expert Systems Development", MGH 1988
- Chung P. W. H Love Grove G., "Industrial Engineering Applications of AL and Expert Systems", Gorden & Breach Science Pub.1993
- Maus R. and Keyes J., "Hand Book of Expert Systems in Manufacturing", MGH,1991
- C. S. Krishnamurthy, S. Rajeev, "Computer Aided Design", Narosa Pub. House
- Ramez Elmasni & Shavkant B. Navath, "Fundamentals of Databar Systems", forth edition -Pearson Education
- Steven Chaptra and Raymond Canale, "Numerical Methods for Engineers", McGraw

Hill publication

- E. V. Krishnamurthy & S. K. Sen, "Numerical Algorithms", East West Press
- S. S. Shastri, "Introductory methods of Numerical Analysis", PHI
- V. Rajaram, "Computer-oriented Numerical Methods", PHI

Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & IV |
| Unit Test 2 | Units II & V |
| Unit Test 3 | Units III & VI |

# K60325: TECHNOLOGY OF METAL CUTTING

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Practical | : 02 Hrs / Week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

Unit-I (08 Hours)

Process of Metal Cutting:

Metal cutting - Introduction, principle, cutting tools, its classification, types of metal cutting process, Mechanism of chip formation, Types of chips, Chip thickness ratio, shear angle, chip breakers, Chip reduction coefficient, Concept of speed, feed & depth of cut and effect of these on cutting forces, Cutting tool materials.

Unit-II (12 Hours)

Theory of Metal Cutting:

Single point cutting tool, Tool geometry, Tool signature, Systems of defining cutting angles of a single point cutting tool, Cutting forces in orthogonal cutting, Merchant's circle of forces, Estimation of cutting forces, Empirical relations, Stress & strain in chip, power requirement, MRR, Ernst – Merchant theory, Lee & Shaffer theory, Forces coming on cutting tools & their measurement using dynamometers. Significance of tool setting at centre with respect to workpiece. Design of a single point cutting tool, Tool holders & tip tools. Machine tool Chatter, Self excited vibrations.

Unit-III (08 Hours)

Machinability, Tool Wear & Tool Life :

Machinability, Machinability Index, Factors affecting machinability, Tool failure - its classification, Tool wear & its types, Tool life, Taylor's tool life equation, Modified by Cherry Brown, Effect of various variables on tool life, Improvement of tool life ( coating of tool ), Heat treatment of tools, Problems. Heat generation in metal cutting, Cutting fluids / coolants: Classification, properties & applications.

Unit-IV (06 Hours)

Economics of Tooling & Advances in Cutting Tools:

Criteria for minimum costs & maximum production, New technology for metal cutting for higher productivity.

ISO / BIS for cutting tools. Advanced tool materials, tools for CNC machines and machining centers, High speed machining etc.

Unit-V (08 Hours)

Design of Multiple Point Cutting Tools:

Nomenclature, classification & design of drills, taps, reamers, milling cutters, broaches, thread cutting tools.

Forces coming on cutting tools & their measurement related to drilling & milling.

Introduction to slot mill cutters, burnishing reamers, honing tools, hobs.

Unit-VI (06 Hours)

Design Principles of Form Tools:

Introduction to form tools - Flat & circular types, Multipoint form tools, combination tools.

Design of circular form tool (Graphical & analytical method)

Design of flat tool.

Selection of tools from standard commercial tool catalogue.

List of Practicals (Any Eight)

- Experiment on chip formation
- Verification of metal cutting theories
- Effect of tool geometry, cutting speed, feed, depth of cut on cutting processes
- Measurement of cutting forces in turning, drilling & milling with the help of tool dynamometers
- Handling & study of various types of multiple point cutting tools
- Design & working drawing of single point cutting tool / boring tool
- Design & working drawing of any one of the following:

  Drill / Reamer / Milling cutter

- Design & working drawing of broach
- Design & working drawing of form tool.(Graphical method)
- Case study for selection of tools from standard commercial tool catalogue

Oral

Based on above syllabus & term work (Experiments).

Text Books / References


- Basu, Mukharjee & Mishra, "Fundamentals of Tool Engineering", Oxford IBH Publishing
- "Tool Engineering Handbook", ASTME, Frank Wilson Editor
- Donaldson, Lecain & Goold, "Tool Design" , Tata Mcgraw Hill
- A. Bhattacharya, "Metal Cutting Theory & Practical", Central Book Publishers
- P. C. Sharma, "A Textbook of Production Engineering", Khanna Publishers
- "Production Technology", H. M. T. Handbook
- Roy, Bagchi, Deshmukh, "Cutting Tool Technology", Nirali Prakashan
- G. R. Nagpal, "Machine Tool Engineering", Khanna Publishers


Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & III |
| Unit Test 2 | Units II & IV |
| Unit Test 3 | Units V & VI |

## K60326: PRODUCTION PRACTICE - II

TEACHING SCHEME
Practical : 02 Hrs / Week

EXAMINATION SCHEME
T. W. & Pr. : 50 Marks

---

Term Work

Each Candidate shall be required to complete and submit the following jobs:

1) One Composite job consisting of 2 to 3 pieces as below
   Machining of components covering all operations on Lathe---- One Job
2) Gear Blank on Lathe Machine-------- One Job
3) Maching of Job on Milling Machine --------One Job (Right angle milling / Angular milling)
4) Grinding operation on milling Job

Note

Practical examination of 6 Hours duration shall be conducted at the end of Sem.-I based on the process and practical conducted in production practice-II

# SEMESTER - VI

# K60327: ADVANCE MANUFACTURING SYSTEM

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Practical | : 02 Hrs / Week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

Unit-I (08 Hours)

High Volume Manufacturing System:

Analysis of automated flow lines, Analysis of transfer line without storage buffer, partial automation, flow lines with storage buffer, computer simulation, assembly line balancing, automated material handling and inspection methods.

Unit-II (08 Hours)

Fundamentals of CAD:

CAD system Definition, use of Computers in Design Process, Manufacturing Data Base Design, workstation, Graphics terminal, input devices, Plotter and other Output devices. Introduction to geometric modeling.

Unit-III (08 Hours)

CNC/DNC Machining:

Principle of operation of CNC, Types, Features, Direct Numerical Control (DNC) and its applications. CNC part programming, axes of CNC machines, manual part programming using G code, Use of subroutines, computer aided part programming using APT or other Language.

Unit-IV (08 Hours)

FMS and Group Technology:

Concept of manufacturing systems and automation, automation strategies, group technology, concept of machine cell and CMS, Building blocks of FMS Planning and implementations of FMS. Group Technology: Part families, Part Classification and coding.

Unit-V (08 Hours)

Robot Technology:

Computer integrated manufacturing (CIM). Elements of robot, robot controller unit, manipulators, end effectors, robot joints, and degrees of freedom, Robot axes and configuration, robot sensors, robot cells layout and applications Simulation Of Manufacturing Systems - Introduction, Concept of System and their Nomenclature, Types of Models, Applications.

Unit-VI (10 Hours)

Fundamentals of Micro Machining:

Defination, energy source, methods and capabilities of micro machining centers, micro EDM, micro wire EDM, micro ECM, micro fabrication.

Nano Tecnology:

Introduction, defination, application, tools, materials, nano manufacturing.

Termwork

Assignments on following Topics

- Programing on CNC Machining.
- Automation.
- Designing a component using PRO-E.
- Design of Robot.
- Flexible Manufacturing System.
- Group Technology.
- Micro Machining.
- Computer Aided Design (CAD).

Oral

Based on Above Term Work.

Text Books / References


- RadhaKrishnan P and Subramanyam, "CAD / CAM / CIM", Wiley Eastern Ltd.

- Groover M P., Automation, "Production System and Computer Integrated Manufacturing", Printice Hall of India
- "HMT Production Technology"
- Degarmo, Black and Kosher, "Material and Processes in Manufacturing"
- Kundra, Rao, Tiwari, "Numerical Control and Computer Aided Designing"
- R K Jain , "Production Technology", Khanna Publication.
- Roy Lindberg, "Processes and Material for Manufacturing"


Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & IV |
| Unit Test 2 | Units II & V |
| Unit Test 3 | Units III & VI |

# K60328: FLUID MECHANICS AND MACHINE TOOL CONTROL SYSTEM

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Practical | : 02 Hrs / Week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

Unit-I (08 Hours)

Fluid Properties and Fluid Statics:

Definition of fluid, Newtonian and non Newtonian fluids. properties of fluids, Types of fluids, Viscosity, specific gravity, Compressibility, Surface tension, Capillarity etc. effect of temperature and pressure on hydraulic fluid.

Pressure at a point, Pascal's law, measurement of pressure, methods, manometers, liquid pressure – horizontal, vertical plane surface.

Unit-II (08 Hours)

Fluid Dynamics:

Types of flow, steady and unsteady, uniform and non uniform, streamline flow, laminar and turbulent flow, Use of Reynolds's number in flow through pipes. Continuity equation, energy equation, momentum equation. Euler's equation of motion along a stream line, Bernoulli's equation, Application of Bernoulli's equation to pitot tube, Venturimeter, Orifices, Orifice Meter, Triangular & Rectangular notch. Calculations of flow, friction and work done by fluid under pressure

Unit-III (08 Hours)

Fluid Power:

Introduction to fluid power: Classification, general feature and application in various fields, hydraulic and pneumatic ISO symbols in fluid power applications.

Fluids for hydraulic power: functions, properties and conditioning of hydraulic fluids.

Sources of fluid power: classification, types and selection of pumps and compressors, Filters.

Distribution of fluid power: selection of conductors for system considering

various factors, sealing and packing devices

Unit-IV (08 Hours)

Control of Fluid Power:

Flow control valves: Compensated and non compensated type, construction and working.

Pressure control valves: Direct acting type, pilot operated, sequence, counter balancing, unloading, pressure reducing, construction and working.

Direction control valves: Types, construction and working, spool actuation methods, spool centre positions.

Actuators: Types, applications and selection.

Unit-V (08 Hours)

Pneumatic System Elements:

Piping materials and pressure ratings, piping layout, calculation of pressure drop in pneumatic line; Air compressors, types, working, selection criteria; FRL unit, construction and working; pneumatic cylinders and air motors, construction and working types, calculation of force and air consumption of air, hydraulic and electric motor.

Hydro pneumatic system: concept, working and applications.

Unit-VI (08 Hours)

System Components and Circuits:

Study of various accumulators, intensifiers, hydraulic jack, power jack, etc. Linear and regenerative circuits with accumulators and intensifiers. Study of various hydraulic and pneumatic circuits for machine tools: components, working and applications. Performance of system.

Fluid power maintenance and safety. Introduction to fluidics, maintenance and study of simple logic gates.

Termwork

A journal containing record of any eight experiments of the following:

- Verification of modified Bernoulli's equation
- Flow through orifice / Venturimeter
- Study of symbols used in fluid power
- Study of different types of valves used in fluid circuits
- Study of actuators / Intensifier / Accumulators
- Design of control circuit for a machine tool
- Study of power pack unit
- At least two experiments on Hydraulic Trainer
- At least two experiments on Pneumatic Trainer

Oral

Based on Above Term Work.

Text Books / References


- Modi P. N. & Seth S. M., "Hydraulics & Fluid Mechanics", Standard book house, New Delhi
- Dr. J. Lal, "Fluid mechanics & hydraulics with computer application", Metropolitan Book Co. Pvt. Ltd., Delhi
- Garde R. J. & Mirajgaonkar, "Engineering Fluid Mechanics", New Chand & Bros., Roorkee
- D. A. Pease, "Basic fluid power", Prentice Hall
- H. L. Stewart, "Pneumatic & Hydraulics", Industrial Press
- A. Esposito, "Fluid power with application", Prentice Hall
- A. B. Goodwin, "Power Hydraulics"
- Sperry Vickers, "Industrial Hydraulic Manual"
- Festo's, "Manual on Pneumatic Principle and Applications"

Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & IV |
| Unit Test 2 | Units II & V |
| Unit Test 3 | Units III & VI |

# K60329: METROLOGY AND QUALITY CONTROL

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Practical | : 02 Hrs / Week | Duration | : 03 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Pr. | : 50 Marks |

Unit-I (08 Hours)

Introduction:

Meaning of metrology, precision, accuracy, errors in measurement, calibration.

Linear Measurement:

Standards- line standard, end standard, wave length standard, classification of standards, precision and non precision measuring instrument, slip gauges.

Angular Measurement:

Sine bar, Sine center, Uses of sin bar, angle gauges, Auto Collimator & Angle Dekkor, Constant Deviation Prism

Unit-II (08 Hours)

Limits, Fits and Tolerances:

Meaning of limit, Fits and Tolerance, Cost-Tolerance relationship, concept of Interchangeability, Indian Standard System (ISS).

Design of limits gauges:

Types, Uses, Taylors principle, Design of limit gauges.

Inspection of geometric parameters: Straightness, Parallelism, Concentricity, Squareness and circularity

Comparators:

Uses, types, advantages and disadvantages of various types of comparators

Unit-III (10 Hours)

Surface finish measurement:

Surface texture, Meaning of RMS and CLA values, Tomlinson's Surface meter, Taylor- hobson surface meter, grades of roughness, specifications.

Screw Thread Metrology:

External screw threads terminologies, floating carriage instruments, pitch and flank measurement of external screw thread, application of Tool Makers Microscope, use of profile projector.

Gear Metrology:

Spur gear parameters, gear tooth thickness measurement, gear tooth vernier caliper, constant chord method, span micrometer, base tangent comparator

Interferometry:

Introduction, flatness testing by interferometry, NPL flatness interferometer.

Study of measuring machines, recent trends in engineering metrology.

Unit-IV (08 Hours)

Introduction to Quality:

Meaning of quality, Approaches-Deming's Approach, Juran's Approach, quality of product, quality of service, cost of quality, value of quality, difference between inspection, quality control and quality assurance, role of quality in present day environment, quality circle, quality policy.

Introduction to quality control:

1) meaning of quality control. 2) 100% inspection and Sampling inspection. 3) Statistics in selective inspection

Introduction to statistical quality control:

Control chart- Attribute (P, np, C, U) and variable (X & R chart), sampling inspection, OC curves and sampling plans, process capability index (Cp, Cpk) concept, methods of determining Cp and Cpk.

Unit-V (08 Hours)

Quality Assurance Systems:

Total quality management (TQM):

7 tools of problem solving, cause and effect diagram, pareto analysis etc, Q.F.D., quality circles, Kaizen, six sigma, 5S system.

Technical Specification (T.S):

TS 16949 standards

Reliability Engineering:

Concept, definitions of MTTF, MTBF, FEMA

Design of experiment:

Meaning, objective, and types of research, approaches, two factorial experiments, and Taguchi method.

Unit-VI (08 Hours)

ISO9001- 2000 series of standards:

History and evaluation of ISO9000 series, importance and over view of ISO9000-1998 series standards, structure of ISO9000-2000 series standards, clauses of ISO9000 series standards and their interpretation and implementation, quality system documentation and audit

ISO14000:

Environmental management concept, and requirement of ISO14001, benefits of environmental management systems.

Termwork

The term work should be in the form of journal consisting of following two sections:

A) Experiments (any eight of the following)

1. Study of linear and non linear measuring instruments
2. Measurement of the surface roughness
3. Measurement of angle by sine bar / sine center
4. Measurement of optical surface using Interferometer
5. Measurement of screw thread parameters using Floating Carriage Micrometer
6. Measurement of gear tooth thickness using gear tooth vernier caliper and span micrometer
7. Study and experiment on profile projector / Tool makers microscope
8. Alignment test on lathe / drilling / milling machine.
9. Experiment to measure Process Capability using Statistical Process Control Or Minitab Software
10. Sampling Inspection

B) Assignments

Any three assignment based on Quality Control syllabus.

At least one industrial visit to Quality Department.

Oral

Term work and oral will be based on above syllabus.

Text Books / References

- R. K. Jain, "Engineering Metrology", Khanna Publication
- K. J. Hume, "Engineering Metrology"
- "Hand Book of Industrial Metrology", A.S.T.M.E. Prentice Hall
- K. W. B. Sharp, "Practical Engineering Metrology", Pitman Publication
- J. M. Juran, "Hand Book of Quality Control", McGraw Hill Publication
- Grant, "Statistical Quality Control", McGraw Hill

Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & IV |
| Unit Test 2 | Units II & V |
| Unit Test 3 | Units III & VI |

## K60330: JIG FIXTURE AND DIE DESIGN

| TEACHING SCHEME | | EXAMINATION SCHEME | |
|---|---|---|---|
| Lectures | : 04 Hrs / Week | Theory | : 80 Marks |
| Drawing | : 02 Hrs / Week | Duration | : 04 Hours |
| | | Unit Test | : 20 Marks |
| | | T. W. & Or. | : 50 Marks |

Unit-I (08 Hours)

Fundamentals of Jigs And Fixtures:

Significance and purpose of jigs and fixtures and their functions in manufacturing processes. Classifications of Jigs and Fixtures. Design features of main elements of Jigs and Fixtures such as locating, clamping and guiding elements and their integrations. Indexing, locking and auxiliary elements. Bodies and bases or frames of Jigs and fixtures. Economics of Jigs and fixtures, Pneumatics & Hydraulics for Jig & Fixtures.

Unit-II (08 Hours)

Design of Jigs & Fixtures:

General guidelines & procedures for design of Jigs and fixtures. Design & selection of standard elements, Analysis of clamping force required & their magnitude, concept of modular fixtures & tool presetting fixtures. Design of drilling jigs, milling and turning fixture.

Unit-III (10 Hours)

Design of Die Castings Dies:

Die casting machines-Hot & cold chamber, metals for die casting, die locking methods, interlocks & safety devices, specific details of die constructions, casting, ejection, cores, slides, loose die pieces, types of cores, directional solidification, types of feeders, die venting, water cooling, classification of dies- single, combination, multi impression. General details of die design, Gating system ,inserted impressions, die casting defects and remedies, die lubrication & rules for die lubrication.

Unit-IV (08 Hours)

Design of Forging Dies:

Design of forging die, selection of parting line, drafts, fillet & corner radii,

ribs & webs, stock size calculation, flash & gutter, design of fullering, edging, blocking and finishing impressions, trimming dies, Die block dimensions, die inserts. Rules for upset forging, defects and remedies.

Unit-V (08 Hours)

Design of Injection Molds:

Specifications and elements of injection molding machine, Injection molding calculations feed system-runner and gates, ejection methods, ejection force calculation, parting surface selection, venting shrinkage, temperature control of mould. Multilayer molds, Defects & remedies.
Use of CAD for mold design.

Unit-VI (08 Hours)

Design of Blow Molds:

Specifications & Elements of Blow Moulding: Determination of number of cavities, types of cooling system, design of cooling channels, heat transfer considerations, types of ejectors, determination of mould opening force & ejection force, use of CAD for mould design, defects and remedies, Roto moulding process

Term Work

- Design & working drawing of one drilling jig.
- Design & working drawing of one fixture.
- Design & working drawing of a die casting die.
- Design & drawing of a injection molding die.
- Assignment of mold design using CAD.
  (All drawings on A2 size drawing sheet)

Oral

Oral will be based on Term work and above syllabus.

Text Books / References


- Donaldson, Lecain & Goold, "Tool Design", Tata McGraw Hill

- Doebler H. H., "Die Casting", McGraw Hill
- P. N. Rao, "Manufacturing Technology", Tata McGraw Hill
- Wilson, "Fundamentals of Tool Design", A. S. T. M. E.
- M. H. A. Kempster, "Introduction to Jigs and Fixtures Design"
- P. H. Joshi, "Press Tools", A.H. Wheeler
- P. C. Sharma, "Production Engineering", S. Chand
- Dr. Surender Kumar, "Production Engg. Design (Tool Design)", Satya Prakashan
- R. G. W. Pye, "Injection Mould Design", EWP
- A. S. Athalye, "Plastic Processing Handbook", Multitech
- Richard Kibbe, John E. Neely, Meyer, White, "Machine Tool Practices"
- Hoffman, "Introduction to Jigs and Fixtures"
- "Tool Engineering Handbook", A. S. T. M. E.
- R. K. Jain, "Production Technology", Khanna Publishers
- Dr. Surender Kumar, "Production Engineering Design"
- "Metals Handbook", Vol II ASME
- "Toll and Die Design Handbook", McGraw Hill
- Hiram and Grant, "Non Conventional Clamping Devices"


Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & III |
| Unit Test 2 | Units II & V |
| Unit Test 3 | Units IV & VI |

# K60331: PRODUCTION PLANNING AND CONTROL

TEACHING SCHEME
Lectures : 04 Hrs / Week

EXAMINATION SCHEME
Theory : 80 Marks
Duration : 03 Hours
Unit Test : 20 Marks

---

Unit-I (06 Hours)

Introduction to PPC:

Role and stages of PPC, PPC as an integrated function, Product Life Cycle Analysis, Types of Production systems.

Unit-II (08 Hours)

Forecasting Techniques:

Use and types of forecasting, Methods of forecasting and comparison, Verification and control.

Unit-III (10 Hours)

Techniques And Production Control:

Process sheet, Routing, Scheduling- Gantt Chart, Machine Loading Chart, Line Balancing, Dispatching rules, Sequencing - Johnson's rule, Loading, Follow- up, Evaluation, PERT, CPM.

Unit-IV (10 Hours)

Materials Planning and Purchasing:

Scope and requirement of MRP, MRP I and MRP II, Master Production Schedule, Bill of Materials, Capacity Requirement Planning, Introduction to ERP, Purchasing - Documentation, Make or Buy decisions, Vendor Development.

Unit-V (10 Hours)

Inventory Control:

Types of Inventory, Cost of Inventory, EOQ, Selective Inventory Control, Replenishment Systems.

Stores Management:

Types of stores, Storage layout and storage systems, Stores

Documentations, Stores Control and Control of Wastage and surplus, JIT, KANBAN, KAIZEN, Value Stream Mapping.

Unit-VI (06 Hours)

Computer Aided Production Planning and Control Applied to :

a) Machine capacity planning and utilization.
b) Productivity measurement.
c) Material Requirement Planning.
d) Scheduling Techniques.

Hands on experience of Computer aided Production Planning and Control.

Text Books / References


- J. L. Riggs, "Production Systems - Planning Analysis and Control ", JhonWiley & Sons.
- J.B. Dilworth, "Operations Management - Design, Planning & Control for Manufacturing and Services ", McGraw Hill
- S N Charry, "Production and Operation Management" Tata McGraw Hill
- Samuel Elion, Elements of PPC ", Universal Book Company
- Martand Telsang, "Industrial Engineering and Production Management" S. Chand and Co. Ltd.
- Moore, "Production Control "
- Mager and Boodman," Production Planning And Inventory Control"
- Martin Star, “Production Management "
- Erry Johnson, “Process Engineering "
- E. EL. Buffa, “Production Management "
- A. K. Bewoor, "Production Planning and Control" Satya Publication
- Jain and Arrawal, “Production Planning and Cost Control”, Khanna Publisher
- Patil S. S. And Nandakumar K. Hukeri, “Industrial Engineering and Production and Operations Management”, Electro-Tech Publication.

Syllabus for Unit Test

| | |
|---|---|
| Unit Test 1 | Units I & II |
| Unit Test 2 | Units III & IV |
| Unit Test 3 | Units V & VI |

# K60332: PRODUCTION PRACTICE III

TEACHING SCHEME
Practical : 04 Hrs / Week

EXAMINATION SCHEME
T. W. & Pr. : 50 Marks

---

Term Work

Each Candidate shall be required to complete and submit the following jobs

1. One Composite job consisting of 3 to 4 pieces as below

   Machining of components covering all operations on Lathe

   (Including Internal and external threading, Taper Matching, Knurling )
   ----------One Job

   Grinding operation on Above (Turning ) Job

2. Gear Cutting ----------One Job

Note

Practical examination of 6 Hours duration shall be conducted at the end of Sem.-II based on the process and practical conducted in production practice-III.

# RULES REGARDING ATKT, CONTINUOUS ASSESSMENT AND AWARD OF CLASS

A. T. K. T.

- A candidate who is granted term for B.Tech. Semester-I will be allowed to keep term for his / her B.Tech. Semester-II examination even if he / she appears and fails or does not appear at B.Tech. Semester-I examination.

- A candidate who is granted term for B. Tech. Semester - III will be allowed to keep term for his / her B.Tech. Semester-IV examination even if he / she appears and fails or does not appear at B.Tech. Semester-III examination.

- A candidate who is granted term for B.Tech. Semester-V will be allowed to keep term for his / her B.Tech. Semester-VI examination if he / she appear and fails or does not appear at B.Tech. Semester-V examination.

- A candidate who is granted term for B.Tech. Semester-VII will be allowed to keep term for his / her B.Tech. Semester-VIII examination if he / she appears and fails or does not appear at B.Tech. Semester-VII examination.

- A student shall be allowed to keep term for the B.Tech. Semester-III course if he / she has a backlog of not more than 3 Heads of passing out of total number of Heads of passing in theory examination at B.Tch. Semester-I & II taken together.

- A student shall be allowed to keep term for the B.Tech. Semester-V of respective course if he / she has no backlog of B.Tech Semester-I & II and he / she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 heads of passing in termwork and practical examination or termwork and oral examination.

- A student shall be allowed to keep term for the B.Tech. Semester-VII course if he / she has no backlog of B.Tech. Semester-III & IV and he / she has a backlog of not more than 3 Heads of passing in theory examination and not more than 3 Heads of passing in termwork and practical examination or termwork and oral examination.

CONTINUOUS ASSESSMENT

- In respect of Term work at B.Tech. Semester-I & II, B.Tech. Semester-III & IV and B.Tech. Semester-V & VI, target date shall be fixed for the completion of each, job, project experiment or assignment as prescribed in the syllabus and the same shall be collected on the target date and assessed immediately at an affiliated college by at least one pair of the concerned teachers for the subject and the marks shall be submitted at the end each term to the Principal of the college.

• Termwork and performance of Practical / Oral examination shall be assessed on the basis of the depth of understanding of the principles involved, correctness of results and not on ornamental or colorful presentation.

• For B.Tech. Semester-VII & VIII, termwork assessment will be done by external and internal examiners jointly during the examination schedule declared by the university. The record of continuous assessment shall be made available to the examiners during Term work and practical and Term work and oral examinations. Examiner shall use this record for overall assessment of the performance of the student. Every practical / termwork assignment shall be assessed on the scale of 20 marks and weightage of 20 marks shall be distributed as follows:

| Sr. No. | Activity | Marks |
|---|---|---|
| 1 | Timely Submission | 04 |
| 2 | Presentation | 06 |
| 3 | Understanding | 10 |

Marks obtained out of 20 for all assignments together will be converted on scale of marks assigned to term work of respective subject in the structure of the course.

CLASS

• The class should be awarded to the student on the basis of aggregate marks obtained together in both the semester of the respective year by him. The award of class shall be as follows.

| | | |
|---|---|---|
| A | Aggregate 66% or more marks | First Class with Distinction |
| B | Aggregate 60% or marks but less than 66% | First Class |
| C | Aggregate 55% or more marks but less than 60% | Higher Second Class |
| D | Aggregate 50% or more marks but less than 55% | Second Class |
| E | Aggregate 40% or more marks but less than 50% | Pass Class |