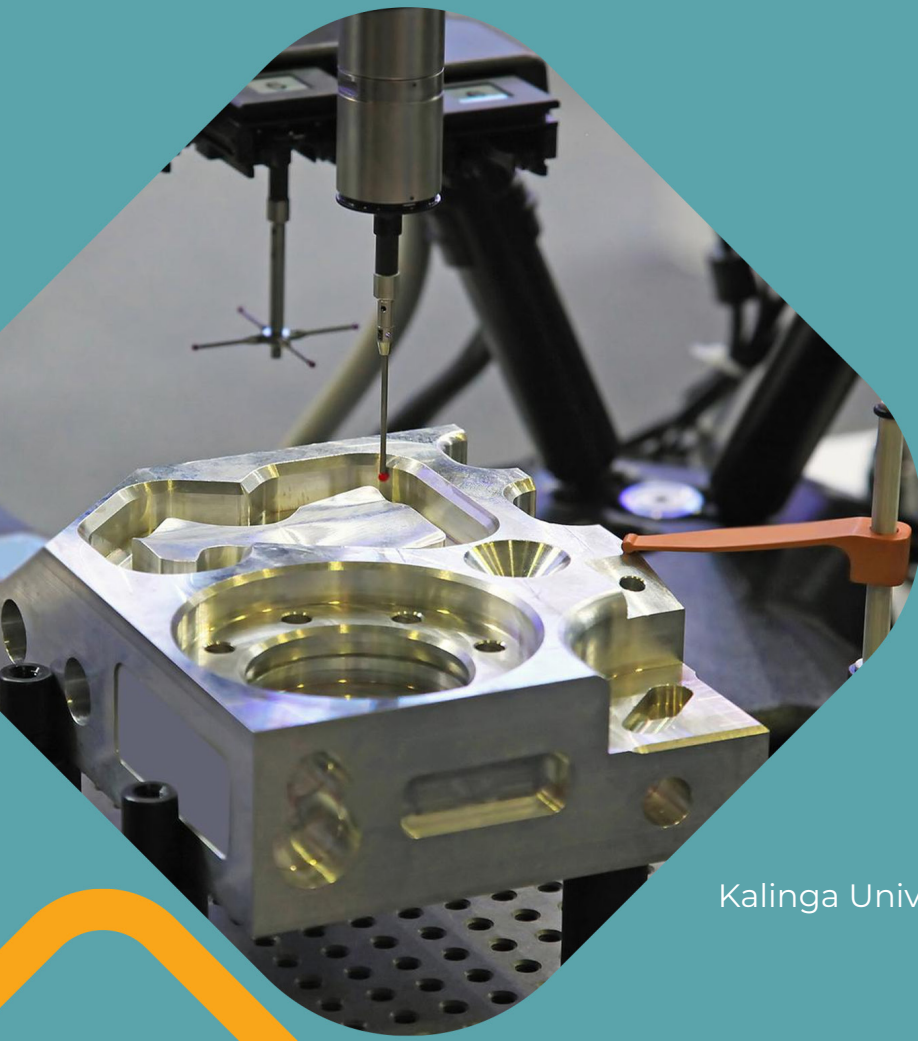




**KALINGA  
UNIVERSITY**

**SCHEME & SYLLABUS FOR**

# **Bachelor of Vocational Studies (B.Voc.) Tool and Dye Making**



Kalinga University, Naya Raipur, Chhattisgarh

# B.VOC IN TOOL AND DYE MAKING

Semester-01								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVTDM101	Communication Skills	3	3	0	0	30	70	100
BVTDM102	Fundamentals of Information Technology	3	3	0	0	30	70	100
BVTDM103	Tool Design and Drawing	3	3	0	0	30	70	100
BVTDM104	Material Science	3	3	0	0	30	70	100
BVTDM105P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
<b>Total</b>		<b>30</b>	<b>12</b>	<b>0</b>	<b>36</b>	<b>170</b>	<b>430</b>	<b>600</b>

Semester-02								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVTDM201	Engineering Metrology	3	3	0	0	30	70	100
BVTDM202	Environmental Studies	3	3	0	0	30	70	100
BVTDM203	Press Tools	3	3	0	0	30	70	100
BVTDM204	Strength of Materials	3	3	0	0	30	70	100
BVTDM205P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
<b>Total</b>		<b>30</b>	<b>12</b>	<b>0</b>	<b>36</b>	<b>170</b>	<b>430</b>	<b>600</b>

Semester-03								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVTDM301	CNC Technology	3	3	0	0	30	70	100
BVTDM302	Fluid Power and Thermal Engineering	3	3	0	0	30	70	100
BVTDM303	Engineering Materials and Metallurgy	3	3	0	0	30	70	100
BVTDM304	Forging Dies, Die casting dies and Die Maintenance	3	3	0	0	30	70	100
BVTDM305P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
<b>Total</b>		<b>30</b>	<b>12</b>	<b>0</b>	<b>36</b>	<b>170</b>	<b>430</b>	<b>600</b>

Semester-04								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVTDM401	Manufacturing Technology	3	3	0	0	30	70	100
BVTDM402	Jigs, Fixtures and Gauges	3	3	0	0	30	70	100
BVTDM403	Plastic Moulding Technology	3	3	0	0	30	70	100
BVTDM404	Tool Room Special Machines	3	3	0	0	30	70	100
BVTDM405P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
<b>Total</b>		<b>30</b>	<b>12</b>	<b>0</b>	<b>36</b>	<b>170</b>	<b>430</b>	<b>600</b>

Semester-05								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVTDM501	Total Quality Management	3	3	0	0	30	70	100
BVTDM502	Computer Integrated Manufacturing	3	3	0	0	30	70	100
BVTDM503	Industrial Engineering and Management	3	3	0	0	30	70	100
BVTDM504	Production Planning and Cost Estimation	3	3	0	0	30	70	100
BVTDM505P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
<b>Total</b>		<b>30</b>	<b>12</b>	<b>0</b>	<b>36</b>	<b>170</b>	<b>430</b>	<b>600</b>

Semester-06								
Course Code	Course Title	Credits	L	T	P	Internal Marks	End Semester Exam Marks	Total Marks
BVTDM601	Production Quality Management	3	3	0	0	30	70	100
BVTDM602	Smart Technologies	3	3	0	0	30	70	100
BVTDM603	Advanced Press Tools and Dies	3	3	0	0	30	70	100
BVTDM604	Injection Mould Design and Analysis	3	3	0	0	30	70	100
BVTDM605P	Industrial Training/On Job Training/Workshop	18	0	0	36	50	150	200
<b>Total</b>		<b>30</b>	<b>12</b>	<b>0</b>	<b>36</b>	<b>170</b>	<b>430</b>	<b>600</b>

# SEMESTER-01

# BVTDM101

## COMMUNICATION SKILLS

### Course Objective:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

### Course outcomes:

- The purpose of this course is to introduce students to the theory, fundamentals and tools of communication
- To develop vital communication skills which should be integral to personal, social and professional interactions.
- One of the critical links between human beings.
- An important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal.
- In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

### Unit - 1

06

**Introduction:** Theory of communication, types and modes of communication, mediums and channels of communication, barriers to communication, English as a global language, the lingua franca, social influences on English

### Unit - 2

06

**Language of Communication:** Verbal and non-verbal (spoken and written) personal, social and business barriers and strategies intra-personal, inter-personal and group communication, varieties of English, language, accent, dialect, colloquialism, historical influences on English

### Unit - 3

06

**Speaking Skills:** Monologue dialogue group discussion effective communication/ mis-communication interview public speech, regional influences on English, convergence and divergence, linguistic imperialism

### Unit - 4

06

**Reading and Understanding** Close reading, reading analysis of a text - audience and purpose, content and theme, tone and mood, stylistic devices, structure comprehension- analysis and interpretation translation (from Indian language to English and vice-versa) literary/knowledge texts

**Unit - 5**

**Writing Skills:** Documenting report writing making notes letter writing, writing tabloids, diary entry, open letters, essays, newsletter and magazine articles, skits, short stories, impersonating characters it will enhance language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note taking etc. while, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. it is hoped that after studying this course, students will find a difference in their personal and professional interactions.

**References:**

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr. Brati Biswas

# BVTDM102

## FUNDAMENTALS OF INFORMATION TECHNOLOGY

### Course objective:

This is a basic course for commerce students to familiarize with computer and its applications in the relevant fields and exposes them to other related courses of IT.

### Course Outcomes:

- Gain a foundational understanding of key IT concepts, including hardware, software, and networks.
- Develop proficiency in using common computer applications, such as word processing and spreadsheet software.
- Explore the ethical and security considerations in IT, emphasizing responsible digital behaviour.
- Acquire problem-solving skills by applying IT knowledge to real world scenarios.
- Prepare for further studies in IT or related fields by establishing a strong IT knowledge base.

### Unit - 1

06

**Computer characteristics:** Speed, storage, accuracy, diligence; digital signals, binary system, ASCII; historic evolution of computers;

**Classification of computers:** microcomputer, minicomputer, mainframes, supercomputers;

**Personal computers:** desktop, laptops, palmtop, tablet; hardware & software; von Neumann model.

### Unit - 2

06

**Hardware:** CPU, memory, input devices, output devices.

**Memory units:** RAM (SDRAM, DDR RAM, RDRAM etc. feature wise comparison only); ROM-different types: Flash memory;

**Auxiliary storage:** Magnetic devices, optical devices; floppy, hard disk, memory stick, CD, DVD, CD/DVD-Writer;

**Input devices** - keyboard, mouse, scanner, speech input devices, digital camera, touch screen voice input, joystick, optical readers, bar code reader;

**Output devices:** Display device, size and resolution; CRT, LCD, LED;

**Printers:** Dot-matrix, inkjet, laser; plotters, sound cards & speaker.

### Unit - 3

06

**Software:** System software, application software; concepts of files and folders, introduction to operating systems, different types of operating systems: single user, multitasking, time-sharing multi-user; booting, POST;

**Basic features of two GUI operating systems:** Windows & Linux (Basic desk top management); Programming Languages, Compiler, Interpreter, Databases;

**Application software:** Generic features of word processors, spread sheets and presentation software; generic introduction to latex for scientific typesetting; utilities and their use; computer viruses & protection, free software, open source.

### Unit - 4

06

**Computer Networks and Internet:** Connecting computers, requirements for a network: server, workstation, switch, router, network operating systems; internet: brief history, world wide web, websites, URL, browsers, search engines, search tips; internet connections: isp, dial-up, cable modem, well, dsl, leased line wireless and Wi-Fi connectivity; email, email software features (send receive, filter, attach, forward, copy, blind copy); characteristics of web-based systems, web pages, web programming languages.

### Unit - 5

06

**Information Technology and Society:** Indian IT Act, intellectual property rights, issues. application of information technology in railways, airlines, banking, insurance, inventory control, financial systems, hotel management, education, video games, telephone exchanges, mobile phones, information kiosks, special effects in movies.

**Programming Concepts & Techniques:** Program concept, characteristics of programme, stages in program development, tips for program designing, programming aids, algorithms, pseudo code, notations, design, flowcharts, symbols, rules, compiler & interpreter. introduction to programming techniques, top-down & bottom-up approach, unstructured, & modular programming, cohesion, coupling, debugging, syntax & logical errors, linking and loading, testing and debugging, documentation.

### References:

1. Programming in C, R.S. Salaria, Khanna Publishing House
2. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
3. Handbook of Computer Fundamentals, N.S. Gill, Khanna Publishing House

# BVTDM103

## TOOL DESIGN AND DRAWING

### Course Outcomes:

After taking this course, the students shall be able to:

- State the different types of limits, fits, and tolerance Design of Press tool-cutting type tools
- Compare, progressive tool with compound tool
- Design of Non cutting dies(Bending and drawing dies)
- Design of fixture for different applications
- Design of drill jig
- Design of limit gauges (Plug, Snap& Ring gauge)

### Unit - 1

10

#### Design Of Press Tools:

Fourteen steps to design a Die – strip layout types of strip layout – wider win, narrow and other layout – calculating of percentage utilization and percentage stop – method of increasing strip utilization – calculation of cutting force, calculation press capacity –Design of die plate strip; die and punch clearance land, angular clearance – design blanking punches – design piercing punches – method of reducing cutting force in progressive dies – Design punch plate, design plots, Design a stop – finger stop, Automatic stops – Design of strippers, Selection of fasteners and moulds - Selection of die sets drawing – Assembly the pillar draw of dies, Adding plunger of die moulds.

### Unit - 2

10

#### Design of Jigs and Fixtures:

Design of Plate jig (turn over type) - Indexing jig - Milling fixture - Grinding fixture.

### Unit - 3

10

#### Gauge Design:

- Design of Plain plug gauge as per IS 3455, IS 6137, IS 6244, IS 6246 and IS 7018 : Part 2
- Design of snap gauge as per IS 3477
- Design of plain ring gauges as per IS 3485

### References:-

1. J.R. Paquin, Die design fundamentals, Industrial Press Inc, 1990.
2. Donaldson, Tool Design , Tata McGraw-hill Book company, 23rd edition, 2006
3. Donald F. Eary., Edward A. Reed, Techniques of Press working sheet metal, Prentice-Hall,Inc., Second Edition, 1974.
4. Indian Standard Specifications IS 3455, IS 6137, IS 6244, IS 6246 ,IS 7018 : Part 2, IS 3477 and IS 3485.

# BVTDM104

## MATERIAL SCIENCE

### Course Objectives:

- To understand the classification of materials, bonding and the crystal structure.
- To understand the Properties of conducting, insulating, semiconducting, dielectric and semiconductor materials.

### Course Outcomes:

After the completion of this course the student will be able to:

- Describe the fundamentals of material science and concepts of unit cell & crystallography.
- Classify materials based on their conducting, insulating, semiconducting, dielectric properties.
- Know the practical uses of various materials in different electrical engineering field.

### Unit - 1

08

- **Introduction:** Introduction and historical importance of Materials, Classification of Materials, Engineering Materials, Advanced Materials and Future Materials like ceramics, polymers, composites, Dielectric etc.
- Bravais Lattices, Crystal Structures, Crystalline, Quasi Crystalline and Non-Crystalline Materials, Miller Indices, Miller-Bravais Indices for Planes and Directions of Cubic and Non-Cubic Structures, structure of ceramics, polymers, and composites materials. Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall Effect.

### Unit - 2

08

- **Diffusion and Heat treatment:** Phase Diagrams: Phase Rule, Equilibrium Phase Diagrams, Phase Systems - Isomorphous, Eutectic with No and Limited Solid Solubility and Peritectic, Iron-Carbon Phase Diagram, TTT Diagram.
- **Imperfections in Solids and Strengthening Mechanisms:** Point Defects, Line Defects and Dislocations, Interfacial Defects and Bulk or Volume Defects, Recovery, Recrystallization and Grain Growth. Alteration of properties by heat treatment, Heat treatment method, Quantification of altered material properties by heat treatments.

### Unit - 3

07

- **Mechanical behavior of Metals and Alloys:** Types of Loading, Stress-Strain Curves for Brittle and Ductile Materials, Theoretical and Observed Shear Stress, Critical Resolved Shear Stress, Deformation – Elastic, Anelastic, Plastic and Super Plastic, Yield Criteria, Macroscopic Aspects of Plastic Deformation, Toughness Measurements by S-S Curve, Impact Testing and Fracture Toughness Testing.
- **Types of Mechanical Loading and Failures:** Ductile and Brittle Fracture, Modes of Fracture Toughness, Impact Fracture, Ductile-Brittle Transition, Types of Impact Testing, Fatigue, Crack Initiation and Propagation, Fatigue Testing, Creep, Stages of Creep Curve, Stress and Temperature Effects.

#### Unit - 4

07

- **Dielectric and Magnetic Property of Materials:** Introduction, polarization of dielectric material, dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, Ferro electricity, piezoelectricity.
- Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.
- **Properties of Metals and Semiconductors:** Energy band in Metals, Semiconductors and Insulators, types of semiconductors, Intrinsic and Extrinsic semiconductors, Effect of temperature on the electrical conductivity of metals, insulator and semiconductor, thermal properties, thermal conductivity of metals and semiconductors, factors affecting the resistivity of electrical materials, electrical conductivity of doped materials, thermoelectric effects.

#### References:

1. C.S.Indulkar and S. Thiruvengadam, S., "An Introduction to Electrical Engineering".
2. P L Kapoor. A Textbook of Electrical and Electronics Engineering Materials: Khanna publishers
3. Kenneth G. Budinski, "Engineering Materials: Prentice Hall of India, New Delhi

# **BVTDM105P**

## **INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP**

# SEMESTER-02

# BVTDM201

## ENGINEERING METROLOGY

### Course Objective:

This subject is intended to teach concepts, principles and procedure of Engineering Metrology to acquire skills in handling and maintaining the measuring instruments for effective use, maintaining standards of inspection and quality control. These skills are used in core technology subjects like work shop practice, manufacturing tools and dies, tool design practice, production planning and cost estimation.

### Course Outcomes:

After taking this course, the students shall be able to:

- List out the needs of metrology
- Explain the working of various linear & angular measuring instruments
- Describe various Measuring Techniques of Gears and threads
- Explain the calibration of measuring Instruments
- Define the various geometric parameters and measure them
- Compare the working Principle of various types of comparators

### Unit - 1

06

#### Introduction to Metrology and Linear Measurement:

- **Introduction:** Metrology, objectives of metrology, Precision vs Accuracy. Repeatability, calibration, sensitivity and readability, classification of methods of measurement, general care of equipment's.
- **Non precision Linear Measurements:** Surface plates, Tool maker's flats and high precision surface plates, Angle plates, bench centers, v-blocks, straight edges, Toolmaker's straight edges, using a straight edge, spirit levels, combination set, universal surface gauge, Engineer's square, Engineer's parallel, Radius gauge, feeler gauge, screw pitch gauge, Engineer's taper, wire and thickness gauge.
- **Precision Linear Measurements:** Characteristics and principles of precision measuring instruments. Vernier instruments, types of vernier calipers, errors in calipers, Vernier height gauge, Vernier depth gauge, digital readout height gauge.
- **Micrometers** – Internal micrometers, micrometer depth gauge, thread micrometer, v-anvil micrometer, dial micrometers, digital micrometers, groove micrometer. Telescope internal gauge, Measuring dia of deep holes, cylinder gauges, Keilpart gauge, slip gauges.

**Unit - 2**

**06**

**Angular Measurement, Measurement of Gears and Threads:**

- **Angular Measurement:** Instruments for angular measurement- optical bevel protractor, universal bevel protractor, acute angle attachment, optical dividing head, Sine bars, Sine center, angle gauges, clinometers.
- Optical instruments for angular measurement: - Autocollimator – principle of the autocollimator, micro-optic autocollimator, measurement of straightness and flatness. Angle dekkor – working principle, use of angle dekkor in combination with angle gauges. Optical square.
- **Measurement of Gears:** Gear tooth terminology, Gear tooth vernier caliper.
- **Thread Measurements:** Screw thread projection, Tool Maker's Microscope, Measurement of Effective Diameter, one wire, Two wire and Three wire Methods using floating carriage micrometer.

**Unit - 3**

**06**

**Measurement of Geometric Parameters and Surface Finish:**

- **Straightness, Flatness, Parallelism and squareness:** - Definition of straightness, straight edge and its uses, test for straightness by using spirit level and Autocollimator, Flatness definition, flatness testing, procedure for determining flatness, laser equipment for alignment testing. Parallelism definition, various cases of parallelism of lines and planes, measurement of equidistance, checking of coincidence or alignment. Squareness definition, measurement of squareness of lines and planes, checking the perpendicularity of motion, squareness testing methods – indicator method, Engineer's square tester, optical tests for squareness.
- **Circularity and Rotation:** - Circularity definition, measurement of circularity, Different types of irregularities of a circular part – ovality, lobbing, irregularities of non-specific form. Roundness and circularity. Devices for measuring circularity error – V block, precision measuring instruments. Tests for checking Rotation – Run out, measurement of run out, Periodical axial slip, camming.
- **Surface Finish:** - Surface roughness – definition, terminologies as per BIS, Methods of measuring Surface finish, surface finish parameters – Surface inspection by comparison methods, Direct measurement methods. Analysis of surface traces.

**Unit - 4**

**06**

**Comparators and Measurement By Light Wave Interference:**

- **Comparators:** Characteristics and uses of comparators, Working principle, advantages and disadvantages of various types of comparators– Mechanical comparators, optical comparators, Electrical comparators, pneumatic comparators, Fluid displacement comparators, optical Projectors.
- **Measurement by light wave interference:** Interferometry, interference of two rays, light source for interferometry, interferometry applied to flatness testing, Interferometers.
- **Testing and Calibration of Gauges:** Calibration of linear and angular measuring instruments – General metrological instrument, optical measuring instruments, Measurement of limit gauges.

**Unit - 5**

**Measuring Machines and Recent Trends In Metrology:**

- **Measuring Machines:** Optical profile projector – working principle, use, precaution in use. Coordinate Measuring Machine – Types, uses, advantages, possible source of error in CMM. Electronic Inspection and measuring machines.
- **Trends in Metrology:** Laser Telemetric system, Feeler microscope, Isometric viewing of surface defects. optoelectronic dimensional gauging, computers in metrology, Computer Aided dimensional analysis and reporting system, In process probing, contact less 3D measurements by Laser based system.

**References:**

1. ASTM E, Hand book of Industrial Metrology, Prentice Hall
2. A.J.T Scarr, Metrology and Precision Engineering, McGraw Hill Book Company.
3. J. Johnson, Precision Measurement, Pitman publishers
4. R.L. Murty, Precision Engineering in Manufacturing, New Age International Publishers (P)

# BVTDM202

## ENVIRONMENTAL STUDIES

### Course Outcomes:

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.

### Unit - 1

06

#### Introduction to Environmental Studies:

Multidisciplinary nature of environmental studies, Scope & importance; concept of sustainability & sustainable development.

#### Ecosystems:

- What is an ecosystem? Structure and function of the ecosystem;
- **Energy flow in an ecosystem:** food chains, food webs and ecological succession.
- **Case studies of the following ecosystems:** Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

### Unit - 2

06

#### Natural Resources:

- **Renewable and Non--renewable Resources:** Land resources and land use change; Land degradation, soil erosion and desertification
- **Deforestation:** Causes & impacts due to mining, dam building on environment, forests, biodiversity & tribal populations
- **Water:** Use & over-exploitation of surface & ground water, floods, droughts, conflicts over water (international & inter-state)
- **Energy resources:** Renewable & non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies

### Unit - 3

06

#### **Biodiversity and Conservation:**

- **Levels of biological diversity:** genetic, species & ecosystem diversity; Biogeographic zones of India; Biodiversity patterns & global biodiversity hot spots, India as a mega-biodiversity nation; Endangered & endemic species of India
- **Threats to biodiversity:** Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions;
- **Conservation of biodiversity:** In-situ and Ex-situ conservation of biodiversity.
- **Ecosystem and biodiversity services:** Ecological, economic, social, ethical, aesthetic and Informational value.

### Unit - 4

06

#### **Environmental Pollution:**

- Types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks
- **Solid waste management:** Control measures of urban and industrial waste. Pollution case studies.

#### **Environmental Policies & Practices:**

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- **Environment Laws:** Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

### Unit - 5

06

#### **Human Communities and the Environment:**

- **Human population growth:** Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies.
- **Disaster management:** floods, earthquake, cyclones and landslides.
- **Environmental movements:** Chipko, Silent valley, Bishnois of Rajasthan.
- **Environmental ethics:** Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

### References:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36--37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29--64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzuhl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

# BVTDM203

## PRESS TOOLS

### Course Outcomes:

After taking this course, the students shall be able to:

- Explain the fundamentals of press working operations
- Compare the different types of press
- Describe the various non-cutting press operations
- Explain the constructions and operations of bending dies and drawing dies
- Compare blanking dies and fine blanking dies
- Explain the concepts of SMED and quick die changer
- State the factors affecting the tool life and their remedies

### Unit - 1

06

#### Press Working Fundamentals, Operations, And Machinery:

- **Press working operations**-Shearing, cutting off, parting, blanking, Punching, piercing, slotting, perforating, Notching, semi notching, lancing, parting, Trimming, slitting, shaving. Safety in press working.
- **Press working mechanism:** Presses according to their functions – energy producing press, force producing presses, stroke controlled presses. Press according to their energy supply – Mechanical, hydraulic, Pneumatic, electromagnetic presses.
- Presses according to their construction – Solid or gap frame, open back inclinable, knee frame, horning, open end or end wheel. Press according to their operation – Single action, double action, triple action, multi slide press. Press actuating mechanisms.
- **Parts of press, press operating parameters** – Tonnage, shut height, stroke, shut height adjustment, strokes per minute, die space. Clearance, cutting terminology, stages of cutting, penetration, burr. Effects of clearance variation – Secondary shear, large clearance, clearance selection, cutting characteristic – Dish distortion, spacing distortion, typical wear.
- **Forces for cutting sheet metal** – Cutting with square faces, cutting with shear, shear on punch, slug bending force, shear on die steel, stripping force.

## Unit - 2

06

### Press & Press Tool Accessories and Types of Die Construction:

- **Mechanical handling devices:** Feeding and reeling mechanisms for coiled sheet metal – Reels and cradles (de-coiler), roll feeds and its types, hitch feeds. Feeding mechanism for individual parts – Hopper feeds, dial feeds, chutes, slides, magazine feeds, step feeds, special feeds.
- **Ejection mechanism** – Gravity, air, kicker, lifter, shovel, mechanical hand, ejection by next part. Transfer mechanisms – Conveyors, shuttle, turnover, turnaround, stacker, rails.
- **Types of die construction:** - Cut off, drop through, return type, compound, combination, continental, sub press, follow die, progressive die, transfer die, shuttle die. Function and nomenclature of die components: - Die, die set, die plate, punch,
- stripper plate, die spring, rubber keeper, stripper bolt, solid stripper, knockout plate, hold down plate, pad plate, blank holder, pressure pin. Types of stock stop.
- **Attachment components** – Dowel, screw, key. Miscellaneous components – Heal, stop block, bolster plate, backing plate, pilot, gauges, insert, cams, hinges and rockers. Commercially available die components – Die sets, die set attachment devices, punches, die buttons, retainers, springs, fluid springs, die cushion and its types.

## Unit - 3

06

### Bending And Forming Dies:-

- **Bending of sheet metal** – Bending theory, neutral axis, metal movement, spring back, methods of overcoming spring back. Bending Operations – Bending, flanging, hemming, curling, seaming, and corrugating. Types of Bending dies (construction and working principle) – V bending and its types, edge bending, u bending. Bending
- operations done using press brake.
- **Forming operations** – Embossing, bulging, crimping, tube forming. Miscellaneous press working operations – slugging, restrike or spank, extrude (holes), coining, hot trimming, cold trimming of die castings and plastic mouldings, riveting, burnishing or sizing, Ironing.
- **Forming dies** – Construction and working principle of solid form dies, pad form dies, curling dies, embossing dies, coining dies, swaging dies, bulging dies. Assembly dies - Riveting, tab stake, upset stake, crimping.

## Unit - 4

06

### Drawing Dies and Dies for Secondary Operations:

- **Drawing operations** – Shallow drawing, deep drawing. Analysis of cup drawing: - Stages of drawing - Bending, straightening, friction, compression, tension, stretch forming. Variables of drawing - Bending and straightening variables, friction variables, compression variables, stretch forming variables, analysis of draw speed. Draw dies & its construction and working principle – Conventional draw die, redrawing die, reverse re drawing die, drawing of square or rectangular shapes.
- **Drawing with flexible tooling** – Marform process, Hydro form process, Hydro dynamic process, Verson- wheel on process. Draw die details – Blank holders, blank holding pressure and its importance, air vents, drawing inserts, draw beads. Drawing defects,
- causes and remedies.
- **Dies for secondary operations:** - Construction and working principle of – Semi piercing dies, shear form dies, dies for formed contours, notching die, shaving die, side piercing die.

Unit - 5

**Fine Blanking Tool And Specialised Press Tool Applications, Press Tool Maintenance**

- **Fine blanking basics:** Definition and Applications of fine blanking, Working principle of fine blanking tool, V Ring – function of V ring, Dimensions of V ring. Comparison of fine blanking with blanking. Strip width and margin calculations, Calculation of press, Fixing minimum distance from die aperture. Factors affecting Tool life. Importance of punch and die radius. Materials suitable for fine blanking, work hardening during fine blanking, steel, copper and copper alloys, aluminum and aluminium alloys
- **Fine Blanking Machines:** Working principle – Ram movement, Drive systems Mechanical drives, hydraulic drives, Machine force, Ring indenter force, counter force.
- **Fine blanking tools:** Different types of tools – Compound die tooling system with sliding punch, compound die tooling with fixed punch. Clearance calculation – Importance of clearance
- **Specialized Press Tool Applications:** Construction, advantage and applications of advanced multistage tooling, unit tooling, angular piercing tools, CNC turret press. Principle or Quick Die Change (QDC) – need and advantages. Single Minute Exchange of Dies (SMED) – concept need and advantages.
- **Factors Affecting Tool Service Life:** Introduction, Elements of Tool performance, Procedure for investigation of tool failure, Trouble shooting in press tools, effect of heat treatment on service life of tools.
- Maintenance and Recondition of press tools – Blanking tool – Progressive Tool – Compound tool – wear and reconditioning of press tools components. Causes of tool and die failure, types of failures.

**References:**

1. Donald F. Eary., Edward A. Reed, Techniques of Press working sheet metal, Prentice-Hall, Inc., Second Edition
2. Donaldson, Tool Design, Tata McGraw-hill Book Company
3. D. Eugene ostergaard, Advanced die making, McGraw-Hill Book company
4. Dr. John G. Nee, Fundamentals of Tool Design, Society of Manufacturing Engineers, Fourth Edition
5. ASTM National Book Committee, McGraw-hill Book Company
6. J.R. Paquin, Die design fundamentals, Industrial Press Inc
7. D. Eugene ostergaard, Basic die making, McGraw-hill Book Company

# BVTDM204

## STRENGTH OF MATERIALS

### Course Objectives:

- Understand the fundamentals of solid mechanics.
- Acquire elementary knowledge of stresses, strains & material properties.
- Understand & analyse the basic principles involved in the behaviour of machine parts under load in the context of designing it.
- Understand & analyse the mechanical properties of the various materials.

### Unit - 1

06

**Basic Concepts:** Definition, elastic & plastic properties of material, stress & strain diagram for ductile & brittle materials, introductory remarks on fatigue, creep & fracture. Simple stresses and strains: Stress & strain, Simple stress and strain in composite sections, Thermal stresses, relation between elastic constants.

### Unit - 2

06

**Principal Planes and Stresses:** Principal stresses and principal planes, Mohr's circle for biaxial stresses.

### Unit - 3

06

**Bending Moment and shearing forces:** Types of beams, types of support, shear force and bending moment diagram for simply supported, and cantilever subjected to point and uniformly distributed loads, relation between intensity of loading shear force and bending moment.

### Unit - 4

06

**Bending, slope and deflection of beams:** Definitions, theory of simple bending, relation between slope and deflection calculations for cantilever & simply supported beams.

### Unit - 5

06

**Torsion & Vibration:** Concept of Pure Torsion, Torsion equation for solid and hollow circular shafts, power Transmitted and stiffness of shaft. Assumptions in theory of pure Torsion, Comparison between Solid and Hollow Shafts, Theory of Failure for Brittle and Ductile material. Types of vibrations, free vibrations.

### References:

1. Strength of materials – Ryder
2. Strength of materials – Sadhu Singh
3. Strength of materials – Rajput
4. Strength of materials – Bansal

# **BVTDM205P**

## **INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP**

# SEMESTER-03

# BVTDM301

## CNC TECHNOLOGY

### Course Objectives:

The student will be able to understand facts, principles and procedure of CNC Technology. This is sophisticated and modern concept of manufacturing components with the help of CNC machine tools. It makes use of CNC programming for CNC control and the sequence of operations are preformed following commands built in the program. The technology is adopted advantageously for complex and complicated contour of the components. Metal cutting has become faster, repetitive, error free replacing manual skills and operations with assured quality of product. The technology is rapidly becoming more economical with the growth of computerization in the filed of Tool & Die Technology.

### Unit - 1

06

#### Introduction:

- **Introduction:** An overview of CNC machining.
- **Definition:** Concept of NC, CNC, DNC machining. Advantages of CNC over conventional machining process. Merits and demerits of CNC machining. Environmental control for CNC machines.
- **Principles:** Working principle of NC, CNC & DNC machining.
- **Procedure:** Study and observe various steps in NC, CNC & DNC machining.

### Unit - 2

06

#### Classification of NC system:

##### Classification based on feedback control:

- **Introduction:** Classification based on feedback control
- **Definition:** Concept and classification based on feedback control such as open loop control system, close loop control system. Feedback devices.
- **Principles:** Principle of feedback control.
- **Procedure:** Study and observe feedback control system.

##### Classification based on control system feature:

- **Introduction:** Classification based on control system feature.
- **Definition:** Concept and classification based on system features such as point-to-point control, straight line control, continuous control system.
- **Principles:** Principle of control system features.
- **Procedure:** Study and observe control system features.

##### Classification based on co-ordinate system:

- **Introduction:** Classification based on co-ordinate system
- **Definition:** Concept and classification based on co-ordinates of points such as absolute co-ordinates, incremental co-ordinate system.
- **Principles:** Principle of absolute and incremental co-ordinate system.
- **Procedure:** Study and observe absolute and incremental co-ordinate system.

#### **Classification based on identification of axis:**

- **Introduction:** Classification based on identification of axis
- **Definition:** Concept and classification based on identification of axes such as linear axis, rotary axis.
- **Principles:** Principle of axis identification.
- **Procedure:** Study and observe identification of axis in CNC machines.

#### **Unit - 3**

**06**

##### **Fundamental of part programming:**

###### **Manual part programming:**

- **Introduction:** Manual part programming and application.
- **Definition:** Concept of NC codes, programming format, G&M codes. Point-to-Point, straight line, curved surface programming.
- **Principles:** Principle of manual programming. ISO standards.
- **Procedure:** Study and prepare manual part programming based on manufacturer instructions and ISO standards.

###### **Computer aided part programming:**

- **Introduction:** Computer aided part programming and application.
- **Definition:** Concept of NC programming on computer. Concept of sub- routines, Do-loops, fixed/ canned cycles.
- **Principles:** Principle of CNC programming.
- **Procedure:** Study and prepare CNC part programming

#### **Unit - 4**

**06**

##### **Tooling for CNC machines:**

- **Introduction:** Tooling for CNC machines and application.
- **Definition:** Concept of design features of cutting tools for CNC, Auto tool changers.
- **Principles:** Principle of selection of cutting tools, auto tools changers.
- **Procedure:** Study and observe tools for CNC machining and automatic tool changers.

##### **Specification of CNC machines:**

- **Introduction:** Specification of CNC machines and purpose.
- **Definition:** Concept of co-ordinates, spindle rpm, linear and rotary axis of rotation. Machine control system / unit of CNC, cooling system.
- **Principles:** Principle of selection of machine control system for CNC machining.
- **Procedure:** Study and identify specification of CNC machines.

#### **Unit - 5**

**06**

##### **CNC operations and machines:**

###### **CNC Lathe:**

- **Introduction:** CNC lathe and turning operations.
- **Definition:** Concept of machine control system, main parts, construction features such as machine reference, work reference and reference plane. Tool and radius compensation.
- **Principles:** Working principle of machine control unit, CNC part programming. Selection of machining variable, system inspection for component accuracy.
- **Procedure:** Study and observe various turning operations on CNC lathe.

### **CNC Milling:**

- **Introduction:** CNC milling and milling operations.
- **Definition:** Concept of machine control unit, main parts, construction features such as machine reference, work reference, reference plane. Selection of tools, tool setting.
- **Principles:** Working principle of machine control unit, selection of machining variables. Tool setting.
- **Procedure:** Study and observe various milling operation on CNC milling.

### **CNC machining center:**

- **Introduction:** CNC machining center and various operations.
- **Definition:** Concept of Milling, Drilling, Reaming, Tapping. Accessories and attachments for various operations, construction features.
- **Principles:** Principle of accessories and attachments for various operations on machining center.
- **Procedure:** Study and observe machining center and accessories and attachments for various operations.

### **CNC EDM-Spark erosion:**

- **Introduction:** CNC EDM-spark erosion and operations.
- **Definition:** Concept of electric discharge machining, dielectric medium, cutting tools, machine variables for spark erosion. Design parameters of tools for spark erosion in CNC machining.
- **Principles:** Principle of EDM, dielectric medium, selection of machining variable and part programming.
- **Procedure:** Study and observe various operations in CNC EDM-spark erosion.

### **CNC EDM-Wire cut:**

- **Introduction:** CNC EDM-wirecut and operation.
- **Definition:** Concept of electric discharge machining with wirecut operations, wire as cutting tool and selection, machining variable, construction features of wirecut EDM.
- **Principles:** Principle of wirecut EDM, machining variable and part programming.
- **Procedure:** Study and observe various operations in CNC wirecut EDM.

### **CNC Grinding Machines:**

- **Introduction:** CNC Grinding machine and grinding operations.
- **Definition:** Concept of machine control unit, construction details, design of grinding features and grinding variables.
- Machine and work references, selection of grinding wheel in CNC part programming.
- **Principles:** Principle of CNC programming for external and internal cylindrical grinding operations.
- **Procedure:** Study and observe CNC programming for various operations in CNC grinding machines.

### **References:**

1. Pabla B.S., CNC machines, Newage International Pvt. Ltd. Publisher, New Delhi
2. Krar Steve Gill Arthur Lynch Mike CNC Technology & Programming
3. Computer numerical control advanced techniques McGraw Hill, New York McGraw Hill, New York

# BVTDM302

## FLUID POWER AND THERMAL ENGINEERING

### Course Outcomes:

- After taking this course, the students shall be able to:
- Define the properties of fluids and explain the working of pressure measuring devices
- Express the working of Pneumatics & hydraulic elements and its circuits
- Explain the concept and application of thermo dynamics
- Describe the working of heat exchangers and its effectiveness
- Specify the Concept and importance of E vehicle & drives
- Outline the Objectives of E V policy & recycling Ecosystem

### Unit - 1

06

#### Properties of Fluids and Pressure Measurements:

- **Fluid-Definition-** Classification of fluids-Ideal and real fluids-Newtonian and non-Newtonian- Properties of fluids-Density, Specific weight, Specific volume, Specific gravity, Compressibility, Viscosity, Surface tension and capillarity.
- **Pressure-** Unit of pressure- Pressure head-Atmospheric pressure-Gauge pressure and Absolute pressure-Problems-Pascal's law-Proof-Applications of Pascal's law-Hydraulic press, Hydraulic jack.
- **Pressure Measurement-** Piezometer tube-Simple U-tube manometer- differential U- tube manometer-Inverted differential U-tube manometer-Micro manometer-Inclined tube micro manometer-Problems-Mechanical Pressure gauge-Bourdan tube pressure gauge-Diaphragm pressure gauge-Dead weight pressure gauge.

### Unit - 2

06

#### Pneumatic System:

- **Pneumatic system and its elements-** Filter, Pressure regulator, Lubricator unit-Pressure control valve-3/2 DCV, 5/2DCV, and 5/3DCV-Check valve- Flow control valve-Throttle valve-Shuttle valve-Quick exhaust valve-Time delay valve-Pneumatic actuators-Single acting cylinder, Double acting cylinder, Air motor, ISO symbols of Pneumatic components.
- **Pneumatic Circuits-**Direct operation of single acting cylinder-Operation of double acting cylinder-Operation of double acting cylinder with metering-in control-Operation of double acting cylinder with metering-out control-Use of shuttle valve in pneumatic circuit-Use of quick exhaust valve in pneumatic circuits-Automatic operation of double acting cylinder-Merits and Demerits of pneumatic system-Applications.



### Unit - 3

06

#### Hydraulic System:

- **Hydraulic system and its elements-** Merits, Demerits and applications of hydraulic system.
- **Hydraulic pumps-** types-positive displacement pumps and non - positive displacement pumps -Gear pumps-External gear and internal gear type-vane pump-Axial piston pump and Radial piston pump-Hydraulic cylinders and Hydraulic motors - ISO symbols for hydraulic components -pressure relief valve-Directional control valves 3/2DCV,4/2DCV,4/3DCV.
- **Hydraulic accumulator and its uses-Types-** Gravity type accumulator, spring loaded accumulator, Gas loaded accumulator-Pressure intensifier.
- **Hydraulic circuits-**Operation of double acting cylinder using metering-in control and metering out control-Operation of Hydraulic motor using metering-in and metering out- control Hydraulic circuit using sequence valves and counter balance valves - Hydraulic circuit for shaping machine, surface grinding machine and Milling machine.
  - Comparison of Hydraulic system and Pneumatic system.

### Unit - 4

06

#### Thermodynamics:

- **Thermodynamic system-**Types-Closed system, Open system and isolated system Property and state of a system-Intensive and Extensive properties -Thermodynamic process-Cycle-Point and Path functions-Law of conservation of energy Thermodynamic equilibrium- laws of thermodynamics.
- **Laws of perfect gases-** -Equation of state-Universal gas constant-Relationship between the specific heats and gas constants.

#### Internal Combustion Engines:

- **Introduction to IC Engines-**Classification-Working of four stroke cycle petrol and diesel engines- Merits & Demerits-Working of two stroke cycle petrol and diesel engines
- **Merits & Demerits-**Comparison of four stroke and two stroke engines.

#### Heat Exchangers:

- Heat transfer in engineering –Modes of heat transfer-Conduction, Convection and Radiation.
- Heat transfer by conduction-Fourier law of heat conduction-Thermal conductivity of engineering materials-Heat conduction through plane wall-Heat conduction through composite wall-Simple problems.
- Newton's law of cooling-Stefan Boltzmann law of radiation.
- Heat exchanger-types, parallel flow heat exchanger, counter flow heat exchangers Application of heat exchangers.



**Unit - 5**

**E-Vehicles:**

- **Environmental impact and history:** Air pollution – Petroleum resources – History of Electric vehicles -History of Fuel Cell Vehicles Battery Electric Vehicle (BEV) – Fuel Cell Electric Vehicle (FCEV) – Description.
- **Electric Vehicles:** Configurations of Electric Vehicle – Performance of Electric Vehicles – Tractive Effort in Normal Driving – energy consumption.

**Hybrid Electric Vehicles:**

- **Concept of Hybrid electric drive trains** – Architecture of Hybrid Electric Drive trains.
- **Electric Propulsion Systems:** Drive Systems: DC motor drives - Principle of operation – Induction Motor drives - Basic operation principles Energy Storages: Electrochemical Batteries – Battery Technologies – Lead Acid Batteries – Nickel Based Batteries – Lithium Based Batteries – Charging system – DC charging – Wireless charging
- **E-vehicle Policy 2019:** Vehicle Population in India – Need of EV Policy – Advantage of EV Eco system – Scope and Applicability of EV Policy –
- **Objectives of EV Policy** – Policy Measures Recycling Ecosystem – Battery and EVs.

**References:**

1. Sundara murthy, Fluid Mechanics and Fluid Power, Narayana publications.
2. Nag. P.K., Engineering Thermodynamics, Tata Mc Graw Hill.
3. R. Srinivasan, Hydraulic and Pneumatic controls, Vijay Nicole Imprints PVT.LTD, second edition, Chennai.
4. Modern electric, Hybrid electric & Fuel cells vehicles –Mehrdad ehsani ,Yimin Gao, Stefano Longo & Kambiz Ebrahimi.
5. Khurmi. R.S, A Test book of Hydraulics, Fluid Mechanics and Hydraulic Machines, S Chand & CO.
6. Khurmi R.S and Gupta.K, A Text book of Thermal Engineering, S Chand & CO.
7. Ballaney. B.L., Applied Thermodynamics, Khanna publishers.
8. Bansal. R.K, Fluid Mechanics and Hydraulic Machines.
9. Electric Vehicles and the end ICE age-Anupam Singh.

# BVTDM303

## ENGINEERING MATERIALS AND METALLURGY

### Course Outcomes:

- Explain the different types of material structure Compare various types of deformation of metals
- Interpret the phase diagrams of solid solution and apply it in Iron Carbon equilibrium diagram
- Differentiate between various heat treatment techniques of Alloy steel and Non Ferrous metals
- Explain the properties of various engineering materials
- Compare the various micro structure of metals

### Unit - 1

06

#### Metallurgy and Material Structure:

- Crystalline Structure Crystallography, crystal, single crystal, crystallization of metals, crystal symmetry, elements of symmetry, space lattice, unit cell, lattice parameters of unit cell, primitive cell, crystal structure, crystal system – cubic system, Tetragonal system, Hexagonal or trigonal system, orthorhombic system, monoclinic system, triclinic system. Miller Indices, Crystal directions, coordinate number, atomic radius, number of atoms per unit cell, density of crystal material. Material structure –Face centered cubic (FCC), Body centered cubic (BCC), Hexagonal close-packed (HCP).
- **Bonding in solids Primary bonds** – Metallic bond, Ionic bond, Covalent bond. Imperfections in metal crystals- types of defect- point defect, line defect, surface defect, volume defect, effect of imperfection on metal properties
- **Deformation of metals:** Elastic deformation, plastic deformation, elastic after effect. Deformation by slip, ideal plastic body. Plastic deformation of a single crystal – slip, twinning. cold working and effect of cold working on metals. Hot working of metals, advantages and disadvantages of hot working.

### Unit - 2

06

#### Phase Diagrams and Iron Carbon Equilibrium Diagram:

- **Phase Diagrams:** Solid solution – types of solid solution- substitutional and interstitial solid solution- solid solution alloy – System, Phase, Component, Degree of freedom or variance of the system. Phase rule, Cooling curves – cooling curve of pure metal, solidification or crystallization of metal, cooling curve of eutectic type alloy. Construction of equilibrium diagrams, Interpretation of equilibrium diagrams. Types of phase diagrams – Eutectic system, Peritectic system, Eutectoid system, Peritectoid system. Iron-Carbon system – allotropy of iron, micro constituents of iron and steel, Iron-iron carbide equilibrium diagram, critical temperatures, effect of alloying elements on Fe-Fe<sub>3</sub>C diagram.
- **Heat Treatment and Transformation Diagram:** Purpose of Heat Treatment, Heat treatment cycle, Time-Temperature-Transformation (TTT) diagram – importance of T.T.T diagram, steps to construct T.T.T diagram, T.T.T diagram for eutectoid steel, T.T.T diagram and cooling curves.

### Unit - 3

06

#### Heat Treatment, Properties of Engineering Materials:

- **Heat Treatment of Steel:** Annealing – stress relief annealing, Process annealing, spheroidise annealing, Full annealing. Normalizing, Hardening – process, quenching medium, hardenability, end quench hardenability test. Tempering – low temperature tempering, medium temperature tempering, High temperature tempering, Temper brittleness, Austempering, Martempering. Case hardening – carburising – pack carburising, liquid carburising, gas carburising. Nitriding, cyaniding, carbonitriding. Surface hardening – flame hardening, induction hardening.
- **Properties of Engineering Materials:** Introduction, Mechanical properties of Materials – Strength, Elasticity, Plasticity, Ductility, Malleability, stiffness, toughness, brittleness, hardness, wear resistance, machinability, castability, weldability, fatigue strength, creep. Thermal Properties – Introduction, Heat capacity, Expansion, conductivity, Thermal stress. Magnetic Properties – Introduction, Diamagnetism, Para Magnetism, and Ferromagnetism, Influence of Temperature on Magnetic Behavior. Superconductivity.

### Unit - 4

06

#### Ferrous And Non – Ferrous Metals and Their Alloys:

- **Ferrous Metals & its Alloys:** Pig Iron – classification, properties and applications, Wrought Iron – composition, properties and uses. Cast Iron – Introduction, classification, effects of alloying elements on the structure of cast iron. Designation system of Cast Iron as per BIS. Composition, Mechanical properties, applications of Grey cast iron, Spheroidal graphite cast iron, Malleable cast iron. Steels – Classification of steel, Effects of alloying elements in steel. Composition, Mechanical properties, applications of low carbon steel, medium carbon steel and high carbon steel. HSS, Tool steel, Stainless steel - Composition, Mechanical properties and applications
- **Non – Ferrous Metals & its Alloys:** Aluminum & its alloys – types, properties and applications. Designation system of aluminum and its alloys as per BIS. Copper & its Alloys – Types, Brass, Gunmetal – Composition, properties & applications, Zinc – Composition, properties & applications.

### Unit - 5

06

#### Metallography, Surface Treatment and Non Destructive Testing:

- **Metallography:** Metallurgical microscope – Preparation of specimen, micro and macro examination. Study of micro structure of Ferrous and Non Ferrous metals. Modern techniques of material studies – electron microscope, photoelectron spectroscopy.
- **Surface Treatment:** Mechanical cleaning and finishing – Vibratory finishing, wire brush cleaning, buffing and electro polishing. Chemical cleaning – Vapour degreasing, solvent cleaning, alkaline cleaning, ultrasonic cleaning, acid pickling. Surface coatings – Electroplating, painting, powder coating, blackening, vacuum Metalizing, Physical vapour deposition, chemical vapour deposition.
- **Non Destructive Testing:** Magnetic particle inspection, X-Ray inspection, Gamma radiography, Ultrasonic Inspection, Electrical methods, Damping test, Non-magnetic methods of crack detection.

#### References:

1. Dr. O.P. Khanna, Material science and Metallurgy, Dhanpat Rai & Sons
2. Material Science and Engineering, William D. Callister JR, Sixth Edition
3. ASM Hand book, Vol.1, ASM International, Materials Park, Ohio, U.S.A,
4. S.K. Hajra Choudhury and A.K. Hajra Choudhury, Elements of Workshop Technology, Media Promoters and publishers pvt. Ltd

# BVTDM304

## FORGING DIES, DIE CASTING DIES AND DIE MAINTENANCE

### Course Outcomes:

After taking this course, the students shall be able to:

- Explain the fundamentals of forging and forging processes Compare the different types of forging
- Illustrate the basics of Die casting Process
- Design a Die casting Die
- Identify the causes and remedies of die casting defects
- Estimate the cost of Dies

### Unit - 1

06

#### Forging Process And Forging Machines:

- **Introduction to Forgings:** Uses and advantages of forgings, forged parts Vs cast parts, Forging Temperatures, annealing of forgings, forging properties. forge ability and forgeable metals
- **Forging processes:** Hot-working and cold-working – Advantages – comparison – hotworking operations: rolling, forging, smith forging, drop forging, upset forging press forging – roll forging – Roll die forging, skew rolling, ring rolling - power required calculations for rolling and forging operations. Forging dies– drop hammers- board hammers, air lift hammers, power drop hammers, capacity of drop hammers. Press forging – Mechanical forging presses, Hydraulic press. Comparison of press forging Vs hammer forging. Machine or upset forgings. Heat treatment of forged parts Heating devices–Box or batch type furnaces, rotary hearth furnaces, continuous or conveyor furnaces, induction furnaces, resistance furnaces. Open fire and stock fire.

### Unit - 2

06

#### Design Of Drop Forging, Press Forging And Machine Forging Dies:

- **Drop Forging Die Design:** Hammer dies for preparatory work – fullering dies – edging dies – flattening dies – Drawing down dies – bending die. Essential features of forging dies – generous radii, parting line position, flash gutter, webs and panels, draft, air vents. Flash areas and gutters in finishing dies. Elements of multi impression die block, effect of grain flow.
- **Press Forging Dies:** Rating of forging press, steps in press forging dies, design of press forgings, design of press forging dies.
- **Machine Forging Dies:-** General characteristics, techniques used in making these orgings, machine forging description and range, machine forging tools and operation, design of dies for forging machines Laws governing forging machine die design, Examples of forgings produced on forging machines, forging defects – causes and remedies.
- **Forging Die Blocks And Dies:** Materials and grade of die blocks, applications of various grades of steel used for die blocks and dies-Die insert-Re-sinking of dies- IS code for tool and die steels

### Unit - 3

06

#### **Die Casting Materials , Machines, Die Materials And Treatments:**

- **Die Casting Materials:** Types of die casting alloys –metallurgy, melting & casting procedure and application of zinc based die casting alloys, Aluminium base alloys, Magnesium base alloys, magnesium base alloys, Copper base alloys, Lead base alloys and Tin base alloys.
- **Die Casting Machines:** Plunger machine, air machine, modern cold chamber machines. Die locking methods, injection systems, automatic cycle control, and interlock and safety devices in die casting machines. Operation of hot chamber and cold chamber die casting machines. Machine specifications, process parameters and their effect on product quality. Effect of die casting machine on the process – accumulator pressure, injection line pressure, intensification, plunger diameter, locking force, mode of injection, plunger diameter, casting cycle, lubrication.
- **Die Materials and Treatments:** Characteristics of Tool and Die steels – Choosing of Tool Steels – Heat treatment of die steels – Tool steel production methods – Die surface coatings and treatments – wrought low carbon steels and Cast irons – Nonferrous and non-metallic die materials.

### Unit - 4

06

#### **Die Casting Die Design, Defects and Finishing of Die Casting Dies:**

- **Die Casting Die Design:** Flow system – Importance, metal flow systems in die casting dies, goose neck, nozzle, sprue, runners systems, shock absorbers, gate, gate area, gate velocity, air vent, overflow, determination of gate area. Procedure to calculate runner and gating dimensions using PQ2 diagram, calculating runner and gating dimensions without PQ2 diagram. Consideration of specification of die casting machines. Ejection systems – need and working of ejection system, Types of ejection system – sleeve, ring, blade
- **Die Casting Defects:** Definition, causes and remedies of defects – Shrink holes, Gas holes, Segregation, Shrink cracks, Porosity, Cold shuts, Flow lines & Blooms, Foliations, Hard spots, Surface draws and Depressions, Soldering, sink mark and excessive flash.
- **Finishing of Die Casting Dies:** Trimming and piercing of die casting dies- omparison die casting dies with other products

### Unit - 5

06

#### **Die Maintenance:**

Good Maintenance Practice – Good grinding practice – Stress relieving cutting tools – shimming die components – ball lock punches and die buttons. Die maintenance documentation and tracking – Die maintenance team – Systematic die maintenance system – Request for maintenance form – Continuous improvement. Effective Die Maintenance Program Strategy – Understanding The Die Maintenance Facility – Addressing Production- Scheduling Programs – Planning Die Maintenance – Tracking The Cost Of Maintenance And Down Time Trouble Shooting Large Panel Stamping Dies – Die Bolting – Nitrogen Pressure Systems – Systematic Approach To Die Tryout – Draw Beads – Double Action Press Operations – Dirt Problems – Forming Ribs And Embossments – Knockout Bars.

#### **References:**

1. S.K. Hajra Choudhury and A.K. Hajra Choudhury, Elements of Workshop Technology, Media Promoters and publishers pvt. Ltd
2. Ivana Suchy, Hand book of Die Design, McGraw-Hill Book company, Second edition
3. Meswani, and R.H.Dattani, Design and Manufacture of forging dies
4. Kamenshichikov, S.Koltun and V.Naumov, Forging Practice, MIR publishers.
5. J.C. Sharman, Drop, Press and Machine Forgings, The machinery publishing co ltd.

# **BVTDM305P**

## **INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP**

# SEMESTER-04

# BVTDM401

## MANUFACTURING TECHNOLOGY

### Unit - 1

06

#### (A) General Introduction:

- i. Scope of subject “Workshop Technology” in engineering
- ii. different shop activities and broad division of the shops on the basis of nature of work done such as
  - Wooden Fabrication-carpentry
  - Metal Fabrication (shaping and Forming, Smithy, sheet metal and Joining-welding, Riveting, Fitting and Plumbing).

#### (B) Carpentry:

- i. Fundamental of wood working operations
- ii. Common Carpentry Tools-

#### Their classification, size, specification (name of the parts and use only):

- i. Marking and measuring tools
- ii. Holding and supporting tools:
- iii. Cutting and Sawing Tools:
- iv. Drilling and Boring Tools
- v. Striking Tools-Mallet and Claw hammer
- vi. Turning Tools & Equipment
- vii. Miscellaneous Tools

### Unit - 2

06

#### Production Technology:

#### (A) Joining of Timber Components for Fabrications Works:

Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet, Groove, Tongue, Dowel, operations in assembly-simple lap and butt, Mortise, Tenon, Dovetail, Miter & bridle joints. Metal Fabrication.

#### (B) Metal Shaping-Smithy:

- i. Operations involved (concept only)
- ii. Tool and equipment used (Names, size, specification for identification only)
- iii. Heating and fuel handling equipment
- iv. Holding and supporting tools
- v. Striking Tools
- vi. Cutting tools
- vii. Punching & Drifting Tools
- viii. Bending Tools and figures
- ix. Forming & Finishing Tools
- x. Defects Occurring & its remedy

**Unit - 3**

**Sheet metal working-**

**Tools and operation:**

- a) Operations involved (Names and concept only)
- b) Sheet metal joints
- c) Tools and equipment used (Name, size, specifications for identification only)
- d) Marking tools
- e) Cutting and shearing Tools
- f) Straightening tool
- g) Striking Tools
- h) Holding Tools
- i) Supporting Tools
- j) Bending tools
- k) Punching-Piercing and Drafting tools
- l) Burring Tools-Files
- m) Defects Occurring & its remedy

**Unit - 4**

**(A) Metal Joining During Fabrication-**

**(a) Permanent Joining:**

- i. Welding methods
- ii. Electric welding

**(b) Soldering & Brazing:**

- i. Its concept, comparison with welding as joining method and classification
- ii. Soldering operation
- iii. Materials Used
- iv. Defects Occurring & its remedy

**(B) Riveting-**

- a) Its comparison with welding as joining method.
- b) Rivets and Materials.
- c) Operation involved
- d) Tools and equipment used (Names, Size, specification and uses)), Elementary knowledge about working of pneumatic, hydraulic and electric riveter. Temporary Joining (Fasteners & their uses), General Idea about temporary fasteners & their uses

**(C) Familiarity with the Use of Various Tools Used in Mechanical Engineering Workshop:**

- a) Marking & Measuring Tools
- b) Holding Tools
- c) Cutting Tools
- d) Files
- e) Thread Cutting Tools
- f) Miscellaneous Tools.

**Unit - 5**

**(A) Protection of Fabricated Structures From Weather:**

**(a) Painting:**

Its need, Introduction to methods of painting (classification only) operations involved description steps only, surface preparation materials, tools and equipment used (name, size specification for identification), Brushes-round and flat wire brush, scraper, trowel, spray gun, compressor, Defects likely to occur in painting and their remedies

**(b) Varnishing & Polishing:**

Its need, operation involved (description of steps only), surface preparation method of old and new articles, application of polishing materials, materials used for preparation of french and spirit polish, copal varnish, Defects likely to occur. Safety of Personnel, Equipment & Tools to be observed

**(B) Foundry Work:**

Elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding.

**References:**

1. Workshop Technology, Vol. I: Hazra & Chaudhry
2. Workshop Technology, Vol. I: BS Raghuwanshi
3. Karyashala Takniki: JK Kapoor

# BVTDM402

## JIGS, FIXTURES AND GAUGES

### Course Outcomes:

After taking this course, the students shall be able to:

- State the requirement, advantages & Limitations of Jigs & Fixtures
- Explain the problems due to chip & Burr
- List the various clamping & Tool Guiding elements
- Describe the constructions of various types of Jigs & Fixtures
- Outline the Principle of Jig & Fixture Design
- Classify the types of Gauges and its Applications

### Unit - 1

06

#### Basics of Work holding Devices:

- **Work holding Concepts** – Basic Work holders, work holder purpose and function, General Considerations Jigs and Fixtures – Introduction – Definition – Difference between Jigs and Fixtures – Advantages of Jigs and Fixtures.
- **Locating and supporting principles** - Location types, Degrees of freedom - 12 degrees of freedom. Location methods - 6 points location principle (or) 3-2-1 principle of location, concentric and Radial methods – Basic rules, position and number of locators, Redundant locators, Locational Tolerances, Fool proofing.
- **Locator Types:** External – Fixed locators, Integral locators, Commercial pin, Assembled locators, Pins, V Type, locating nests. Adjustable locators, Sight locators. Internal – Machined internal, Relieved, Diamond pins, Floating locating pin, conical locators, self-adjusting locators, spring locating pins. Spring stop buttons. Chip and burr problems

### Unit - 2

06

#### Clamping and Tool Guiding Elements:

- **Clamping:** Clamping principles – Tool forces, clamping forces, positioning clamps. Rigid Vs Elastic work holders. Types of Clamps – Strap clamp, screw clamp, cam action clamps, Toggle action clamps, wedge action clamps, latch clamps, rack and pinion clamps, specialty clamps. Chucks – Operations, Nomenclature. Lathe chucks – Solid Arbors and Mandrels. Split collet and bushing work holders, axial location, self-actuating wedge cam and wedge roller work holders. VISES – Special jaws, independent jaws.
- **Non-Mechanical Clamping** – Magnetic chucks, vacuum chucking, Electrostatic chuck. Power Clamping – Hydraulic and Pneumatic clamping. Multiple part clamping.
- **Tool Guiding Elements:** Drill jig bushings and liners – Selection, Bushing / liner installation, interference fit, chip clearance, accuracy and life. Types of bushes – Head less press fit bushes, Headed press fit bushes, Slip renewable and Slip fixed renewable bushings / liners, Headless press fit liners, Headed press fit liners, Oil groove bushings, Gun drill bushings, Special bushings. Bushings and liners for polymers, castable and soft material tooling. Template bushings, Rotary bushings. Drill bushing tips and accessories. Drill bush material and manufacture.

### Unit - 3

06

#### Principles of Jig Design:

- **Introduction** – General considerations – Machine considerations – Process considerations. Basic requirements of Drill jigs.
- **Types Of Jigs** – Diameter jig, Ring Jig, Template drill jigs, Plate jigs, Universal jigs, Leaf jig, Channel and Tumble box jigs, Indexing Jigs, Boring jigs, – Post jig – Pot jig. Miscellaneous drill jigs – Wooden drill jigs, Polymer Drill Jigs, modified vises, collet Fixtures, self-centering vises. Jig design Example – Plate Jig design example

### Unit - 4

06

#### Principles of Fixture Design:

- **Introduction:** General Considerations, fixture cost, production capabilities, Production process, part considerations.
- **Types of fixtures** – Milling fixture, Lathe fixture, Grinding fixture, Broaching fixture, Assemble fixture, Inspection fixture, Boring fixture, Indexing fixture, welding fixture and sawing fixture.
- **Basic Design Characteristics that apply to** – Milling fixture, Lathe fixture, Grinding fixture, Boring fixture, Broaching fixture, welding fixture and sawing fixtures. Fixture Design - Standard fixture mounting, Relationship between fixture and cutting tool, Tool positioning, Relationship to locators, Cutter-setting devices, Step by step approach to fixture design. Fixture design Example – Plain Milling fixture. Fixture design for numerically controlled machine Tools

### Unit - 5

06

#### Gauges:

- **Introduction** – limit gauges –Taylor’s principle of limit gauging – Application of limit gauges – Gauging principles – Allocation of **Gauge Tolerance** – Bilateral system, Unilateral system, Gauge wear allowance, Gauge materials, Gauging policy.
- **Types of Gauges** – Commercial Gauges – Screw pitch gauges, plug gauges, Ring gauges, Snap gauges, Flush pin gauges– IS specifications for gauges – Design of plug and Snap gauges.

#### References:

1. Cyril Donaldson, Tool Design, Special Indian Edition, 2012, Tata Mc Graw Hill
2. P.C. Sharma, A Text Book of Production Engineering,, 2013, S.Chand & Co
3. G.K. Vijay araghavan, Design of Jigs,Fixtures and Press Tools, Suchitra publications
4. Edward Hoffman, Jig & Fixture design

# BVTDM403

## PLASTIC MOULDING TECHNOLOGY

### Course Outcomes:

- List out the different plastics materials and their properties
- Explain the types of injection moulding machine their specification and operational procedure
- Compare different moulding process used in industries and their application
- Explain the design procedures of injection moulding and compression moulding
- Illustrate the concepts in the design of blow moulds
- Describe the decoration techniques, plating techniques used for plastic components

### Unit - 1

06

#### Plastic Materials and Processing techniques:

- **Plastics:** Introduction – type of Plastics - Thermo Plastic Materials – Thermo setting Materials – Commodity Plastics – Engineering materials – Density - Melting Temperature – Shrinkage – Bulk Factor – Moulding Properties – Applications – Additives - Master Batches – Pigments.
- **Injection Moulding:** Hot Runner Injection Moulding Process, Multi colour and multi component Injection Moulding Process, Reaction Injection Moulding Process.
- **Blow Moulding:** concept and working principle only
- **Compression & Transfer Moulding** – Compression Moulding Procedure- Difference between Injection and Compression moulding. -Transfer Moulding Advantages and Disadvantages.
- **Other processes:** Rotational Moulding, Thermoforming, Extrusion- Pipe extrusion, Blown film, Cast film extrusion, Rod Extrusion– Co extrusion

### Unit - 2

06

#### Injection Moulding machine, injection Mould and its functional systems:

- **Injection Moulding Machines:** Basic parts and functioning of an injection moulding machine. Types of injection moulding machine (Screw type & Plunger Type) – Single stage and two stage – Clamping unit (Toggle & Hydraulic) - Types of nozzles – Typical injection. Moulding cycle, Cycle time - Machine specifications (Definition only).
- **Injection Mould:** Terms used in connection with injection moulds, classification of moulds, Functions of the injection moulds.
- **Functional systems of injection mould** – Sprue and runner system - Runner, Cross section shape, Runner size, Runner layout – Gates, Necessity, Centre gate, Edge gate, Balanced gating, Types of Gates. Core and Cavity- Shrinkage calculation - Core and cavity dimension. Parting surface: Flat Parting surface – Non flat parting surface - Venting – Mould clamping - direct, indirect.
- **Cooling System** – Cooling Integer type cavity plates – Cooling integer type core plate - Cooling bolster – Cooling cavity inserts – Cooling core inserts – Water connection and seals. (Concept & Description of design only)
- **Ejection system:** Ejector grid - Ejector plates assembly – Ejector rod, Ejector plate and ejector retaining plate - Methods of Ejection – Ejection from fixed half- Sprue puller.

### Unit - 3

06

#### **Injection Mould Design & Intermediate Moulds:**

- **Basic procedure for mould design** – Determination of mould size Maximum number of cavities, Clamping force, Maximum clamping area, Required opening stroke. Computation of number of cavities, cavity layouts, number of parting lines, Design of runner and gate.
- **Intermediate Moulds:** Moulding external undercuts-Split mould - Finger cam, dog leg cam & track. Hydraulic & spring actuation of split - Side core and side cavity, Methods of actuation - Mould with internal undercut: Form pin, actuation, split core, jumping off - Mould for threaded component: Manual & automatic unscrewing methods hand mould for rotating & lose core methods - Multi day light mould – Under feed mould – Triple day light mould – Hot runner unit mould, Advantages and Limitations, Hot runner nozzles & sprue, runner less mould - Materials for Injection Mould – Standard Mould systems, Advantages and limitations (Concept & Description of design only).
- **Alignment of Moulds:** Functions of alignment, alignment with the axis of the plasticizing unit, internal alignment and interlocking, alignment of large moulds. Changing of moulds – system for a quick change of moulds for thermoplastics, mould exchanger for elastomer moulds.

### Unit - 4

06

#### **Compression, Blow and Transfer Moulding machines and Mould Design:**

- **Compression & Transfer Moulding Machines:** - Type of compression Moulding Machine – Toggle type mechanical machine – Hydraulically operated Machine – Auxiliary Ram type machines (Vertical Transfer Machine) – Bottom Transfer Machine – Machine Parts – Machine Specifications- Pot and plunger Transfer machines
- **Compression mould Design:** Economic determination of no. of cavities, flash thickness allowances, design of mould cavity, design of loading chamber, bulk factor, loading chamber depth & heat requirement for heating the mould related to - curing time, breathing time. Materials for Compression mould.
- **Blow moulding Machines** - Extrusion Blow Moulding Machine (EBM) – Stretch Blow Moulding Machine (SBM) – Injection Blow Moulding Machine (IBM) – Machine Parts – Machine Specifications.
- **Blow Mould Design:** Mould layout, pinch off, venting, Head die design, parison diameter calculation, shrinkage calculation, design of mould clamping accessories.

### Unit - 5

06

#### **Plastic Product Design, Decoration of Plastic Products and Maintenance & Repair of Injection Moulds:**

- **Plastic Product Design:** Wall thickness - Ribs and profiled structures –Gussets or support ribs - Bosses - Holes - Radii & Corners - Tolerances - Coring - Undercuts – Draft angle.
- **Decoration of Plastic Parts:** Painting and coating (Dipping, Spraying and Depositing) – Metalizing (Vacuum metallization, Vacuum evaporation, sputtering) – Plating (Electroless plating, Electrolytic plating) - Flame and arc spraying - hot foil stamping – hot transfer – In mold decorating - Water transfer – Printing–Laser Marking, Vapor polishing, Decals - Understanding Recycling Codes.
- **Maintenance of Injection Moulds:** Advantages of Preventive maintenance, maintenance of - cooling lines, mould surfaces, heating & control systems. Action taken after examination and cleaning. Repair and alterations of injection moulds.

**References:**

1. Pye. R.G.W., "Injection Mould Design", Affiliated East – west press pvt Ltd, 2000
2. Athalye. A.S., 'Injection Moulding", 2nd Edn., Multi Tech Publishing Co., 1998
3. George menges and Paul mohren, "How to make Injection moulds", Hawer publishers, 1991
4. Briston and Gosselin, "Introduction to Plastics", Newnes-Butterworths, London, 1970
5. Mills. N.J., "Plastics", ELBS, 1986
6. Dominick V. Rosato and Donald V. Rosato., "Injection Moulding Hand Book", CBS Publishers & Distributors, Delhi, 1987
7. Athalye. A.S., "Plastics Materials Handbook", Multi Tech Publishing Co., 1995

# BVTDM404

## TOOL ROOM SPECIAL MACHINES

### Course Outcomes:

- Describe the different forces in orthogonal cutting and oblique cutting
- Compare the properties of different cutting fluids
- Explain the working of drilling machine, boring machine, and jig boring machine
- Describe the working of milling machine
- Distinguish the various types of milling cutter
- Explain the working of various non-conventional machining process

### Unit - 1

06

#### Cutting Tools and Mechanics of Metal Cutting:

- **Cutting tools-** properties of cutting tool materials-cutting tool materials; High carbon steels, high speed steel, carbides, ceramics. types of cutting tools
- **Types of metal cutting** – orthogonal and oblique cutting- chip formation – continuous, discontinuous, built-up edge – shear angle. Tool signature – importance cutting forces in orthogonal cutting – metal removal rate [MRR] – tool life; Taylor's life equation, factors influence in tool life. measurement of cutting force – tool dynamometer – types of tool dynamometer – machinability – machinability index – factors affecting machinability – cutting fluids – properties of cutting fluids – selection of cutting fluids – selection of cutting fluids

### Unit - 2

06

#### Boring, Jig Boring, Jig grinding, Tool and Cutter Grinder and Cylindrical Grinder:

- **Boring and jig boring** -Boring machines- horizontal and vertical types- fine boring machines- boring tools jig boring machine- measuring system- hole location procedure- deep hole boring
- **Jig grinding Introduction-** construction- operation techniques- setting up and clamping- wheel travel- wheel selection- wheel dressing. optical profile grinding- basic principle and operations
- **Tool and cutter grinder Introduction- selection** of cutter- grinding wheels- shape, abrasive grain size and bond, direction of rotation- tooth rest, types, parts of universal tool and cutter grinder, clearance, width of land- producing of clearance angle
- **Cylindrical Grinding Machine Centre Type Cylindrical Grinding Machine** – Centre less Grinding Machine – Through feed Grinding – In feed Grinding

### Unit - 3

06

#### Milling Machines and Gear Generation Processes:

- **Milling machines; Types-specification of milling machines-** principles of operation of column and knee type and universal milling machine- work and tool holding devices; Arbor, spring collet, adapter – milling cutters; cylindrical milling cutter, slitting cutter, side milling cutter, angle milling cutter, T-slot milling cutter, woodruff milling cutter, fly cutter-nomenclature of cylindrical milling cutter-milling process; conventional milling and climb milling-milling operations-milling attachments.
- **Generation process Gear shaper-** gear hobbling- principle of operation only gear finishing processes- gear burnishing- gear shaving- gear grinding & gear lapping- gear materials; cast iron, steel, alloy steels brass, bronze, aluminum & nylons.

### Unit - 4

06

#### CNC Machine and its Components:

- **CNC machines; Numerical control-** definition- working principle of a CNC system- features of CNC machines- advantages of CNC machines- difference between NC and CNC- construction and working principle of turning principle- construction and working principle of machining centre-machine axes conventions turning centre and machining centre.
- **Components of CNC machine; slide ways-** requirement- types- friction slide ways and antifriction slide ways- linear motion bearings- recirculation ball screw- ATC- tool magazine – feedback devices- linear and rotary transducers- encoders- in process probing- tool material- tool inserts.

### Unit - 5

06

#### Un-Conventional Machining:

- **Un- conventional Machining Processes:** Construction, working and applications of ultrasonic machining- chemical machining- electro chemical grinding- plasma arc machining- LASER machining- advantages- disadvantage,- Electron Beam Machining – Abrasive Jet Machining
- **Electrical discharge machining:** Introduction- principle of spark erosion and requirements of dielectric fluid- layout of spark machining system, EDM machine- tool materials – electrical circuits in EDM- metal removal rate- mean current- operation parameters and typical values and tool wear-reasons- classification and types. EDM process characteristic- advantages and disadvantages of EDM process- wire-cut EDM, CNC Wire-cut EDM for machining punch and die cavities.

#### References:

1. Hajra choudhry, "Work shop Technology", Vol. II, Media Promoters and Publishers Pvt. Ltd.
2. Chapman. W.A.J., "Work shop Technology", Vol. II & III, ELBS
3. Paul De Garmo.E., & Others, "Materials and Processes in Manufacturing", Macmillan Publishing Company
4. Jain & Gupta, Production Technology, Khanna Publishers, 2-B, North Market, Naisarak, new Delhi

# **BVTDM405P**

## **INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP**

# SEMESTER-05

# BVTDM501

## TOTAL QUALITY MANAGEMENT

### Course Outcomes:

- Understand the dimension of quality, characteristics of TQM and ISO 9001:2008 QMS
- Apply various concepts of QC Tools and Control charts for Continuous process improvement
- Explain the various statistical data and comparison of frequency distribution statistical analysis functions of production planning and control, total quality management and implement OC and SQC tools in personal and professional career.
- Understand and construct the various control charts for variable and attributes
- Understand the various Management Planning Tools and apply for Quality & production improvement

### Unit - 1

06

#### Basic Concepts of Total Quality Management:

Quality-Definitions - Dimensions of quality - Brainstorming and its objectives - Introduction to TQM – Characteristics – Basic concepts – Elements – Pillars – Principles - Obstacles to TQM implementation – Potential benefits of TQM – Quality council – Duties – Responsibilities – Quality statements – Vision – Mission – Quality policy statements – Strategic planning – Seven steps to strategic planning – Deming philosophy- Customer delight - ISO 9001:2008 Quality Management System requirements and implementation.

### Unit - 2

06

#### Continuous Process Improvement – Q7 Tools:

Input / Output process model – Juran Trilogy – PDCA (Deming Wheel) cycle – 5S Concepts – SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE – needs and objectives – effective implementation of 5S concepts in an organisation - Housekeeping – Kaizen. **Seven tools of quality control (Q-7 tools)** – Check sheet – Types of check sheet – Histogram – Cause and effect diagram - Pareto diagram – Stratification Analysis – Scatter diagram-Graph/run charts – Control charts - Construction of above diagrams. Quality circle - concept of quality circle - Organisation of Quality circle and objectives of Quality circle.

### Unit - 3

06

#### Statistical Fundamentals:

Types of Data – Collection of Data – Classification of Data – Tabular presentation of Data – Graphical representation of a frequency distribution – Comparison of Frequency distribution – Mean – Median – Mode – Comparison of measures of central tendency – Introduction to measures of dispersion – Sample – sampling - Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems.

**Unit - 4**

**06**

**Control Charts:**

Control chart – Types of control charts – Control chart for variables – Construction of X and R charts – control limits Vs specification limits – Process capability – Method of doing process capability Analysis – Measures of process capability – Problems. Attributes – Control charts – P chart – np chart – c chart – u chart – Construction of above diagrams – Problems - Comparison between variable chart and Attribute chart.

**Unit - 5**

**06**

**Management Planning Tools & Bench Marking:**

Affinity diagram – Radar Diagram - Inter Relationship diagram (Inter Relationship diagram) – Tree diagram - Prioritization matrix – Matrix diagram – Decision tree – Arrow diagram – Matrix data analysis diagram - Construction of above diagrams. Bench marking – Objectives of bench marking – Types – Bench marking process - Benefits of Bench marking – Pit falls of Bench marking-Just In Time(JIT) concepts and its objectives - Total Productive Maintenance(TPM) - Introduction, Objectives of TPM - steps in implementing TPM.

# BVTDM502

## COMPUTER INTEGRATED MANUFACTURING

### Course Outcomes:

After taking this course, the students shall be able to:

- Understand the concept of integration of design and manufacturing.
- Explain the activities and benefits of CAD and describe the transformations, modelling, standards used in the CAD software.
- Describe the function and benefits of CAM and explain the concept of GT, CAPP, MPS, MRP and QFD in the CAM.
- Explain applications and advantages of CNC machines and technology and use international codes to write program for CNC turning, milling machine.
- List the components and describe the working principle of FMS, AGV and Robot.
- Explain the advanced concepts of CIM and describe the working principle of QFD, HOQ, and FMEA, AR.

### Unit - 1

06

#### Computer Aided Design

- **Introduction** – definition – Shigley’s design, process – CAD activities – benefits of CAD - CAD software packages – point plotting, drawing of lines, Bresenham’s circle algorithm,
- **Transformations:** 2D & 3D transformations – translation, scaling, rotation and concatenation. Geometric modeling: Techniques - Wire frame modelling – applications – advantages and disadvantages.
- **Surface modelling** – types of surfaces – applications – advantages and disadvantages – Solid modelling – entities – advantages and disadvantages – Boolean operations - Boundary representation – Constructive Solid Geometry – Comparison.
- **Graphics standard:** Definition – Need - GKS – IGES – DXF.
- **Finite Element Analysis:** Introduction – Development - Basic steps – Advantages.
- CAD – Roles of CAD in design – Development and uses - Applications – Advantages – Product cycle – Design process: Shiley Model, Pahl and Beitz Model

### Unit - 2

06

#### Computer Aided Manufacturing

- **CAM** – Definition -functions of CAM – benefits of CAM. Introduction of CIM – concept of CIM – evolution of CIM – CIM wheel – Benefits integrated CAD/CAM. Group technology: Part families – Parts classification and coding- coding structure – Opitz system, MICLASS system and CODE System.
- **Process Planning:** Introduction – Computer Assisted Process Planning (CAPP) – Types of CAPP - Variant type, Generative type – advantages of CAPP. Production
- **Planning and Control (PPC):** Definition – objectives - Computer Integrated Production management system – Master Production Schedule (MPS) – Capacity Planning – Materials Requirement Planning (MRP) Manufacturing Resources Planning (MRP-II) – Shop Floor Control system(SFC)-Just In Time manufacturing philosophy(JIT)-Introduction to Enterprise Resources Planning (ERP).

### Unit - 3

06

#### **CNC Machines, Components and Programming:**

- **CNC machines:** Numerical control – definition – working principle of a CNC system – features of CNC machines – advantages of CNC machines – difference between NC and CNC – construction and working principle of turning centre – construction and working principle of machining centre – machine axes conventions turning centre and machining centre – co-ordinate measuring machine – construction and working principle- types and features.
- **Components of CNC machine:** Slide ways – requirement – types – friction slide ways and anti-friction slide ways – linear motion bearing – recirculation ball screw – ATC – tool magazine – feedback devices – linear and rotary transducers – encoders – in process probing – tool material – tool inserts.

### Unit - 4

06

#### **FMS, AGV, AS/RS, Robotics:**

- **FMS:** Introduction – FMS components – FMS layouts – Types of FMS: Flexible Manufacturing Cell (FMC) – Flexible Turning Cell (FTC) – Flexible Transfer Line (FTL) – Flexible Machining System (FMS) – benefits of FMS introduction to intelligent manufacturing system.
- **Material handling in CIM environment:** Types
- **AGV:** Introduction – AGV – working principle – types – benefits.
- **AS/RS:** Introduction – working principle – types – benefits.
- **Robotics:** Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical grippers – vacuum grippers – robot programming concepts - Industrial applications of Robot: Characteristics - material transfer and loading – welding - spray coating - assembly and inspection.

### Unit - 5

06

#### **Advanced Concepts of CIM:**

- **Concurrent Engineering:** Definition – Sequential Vs Concurrent engineering – need of CE – benefits of CE.
- **Quality Function Deployment (QFD):** Definition – House of Quality (HOQ) – advantages – disadvantages.
- **Steps in Failure Modes and Effects Analysis (FMEA)** – Value Engineering (VE) – types of values – identification of poor value areas – techniques – benefits. Guide lines of Design for Manufacture and Assembly (DFMA).
- **Product Development Cycle:** Product Life Cycle - New product development processes. Augmented Reality (AR) – Introduction - concept – Applications.

#### **References:**

1. R. Radhakrishnan, and S. Subramanian, "CAD/CAM/CIM", New Age International Pvt. Ltd.
2. Mikell P. Groover, and Emory Zimmers, "CAD/CAM", Jr. Prentice Hall of India Pvt., Ltd.
3. Dr. P.N. Rao, "CAD/CAM Principles and Applications", Tata McGrawHill Publishing Company Ltd.
4. Ibrahim Zeid, "Mastering CAD/CAM", Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. Mikell P. Groover, "Automation, Production Systems, and Computer- Integrated Manufacturing", Pearson Education Asia.
6. Yoram Koren, "Computer control of manufacturing systems", McGraw Hill Book.

# BVTDM503

# INDUSTRIAL ENGINEERING AND MANAGEMENT

## Course Outcomes:

- Explain the types of plant layout, plant maintenance, safety laws and settlement of Industrial dispute.
- Apply various concepts of method study to compile QC Tools and to improve quality control of Living through various means of productivity enhancement.
- Illustrate various functions of personnel management and compute wages and incentives.
- Explain the various Process of Entrepreneurship and Benefits of Entrepreneur.
- Explain and distinguish various sources of capital to find the selling price of a product by implementing various costs.
- Understand the Engineering Ethics and Human Values of solving ethical conflicts.

## Unit - 1

06

### Plant Engineering and Plant Safety:

- **Plant Engineering:** Plant – Selection of site of industry – Plant layout – Principles of good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance.
- **Plant Safety:** Importance - accident - causes and cost of an accident - accident proneness - prevention of accidents - Industrial disputes - settlement of Industrial disputes - Collective bargaining, conciliation, Mediation, arbitration - Indian Factories Act 1948 and its provisions related to health, welfare and safety.

## Unit - 2

06

### Method Study, Quality Control and QC Tools:

- **Method Study:** Definition – Objectives – Selection of a job for method study – Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man Machine chart, String diagram and flow diagram.
- **Quality Control:** Definition – Objectives – Types of inspection – First piece – Floor and Centralized inspection – advantages and disadvantages of quality control – Statistical Quality Control (SQC) – types of measurements – method of variables – method of attributes.
- **Seven QC Tools:** Check sheet – Histogram – Pareto diagram – Stratification – causes and effects (ISHIKAWA diagram) – Scatter diagram – control charts (X, R, p,c) – Description only – Introduction to new 7 QC tools - Six sigma – Failure mode effective analysis (FMEA) – sampling inspection – single and double sampling plan.- 5S concepts - needs and objectives.

### Unit - 3

06

#### **Principles, Personnel Management and Organizational Behavior:**

- **Principles of Management:** Definition of management – Administration - Organization – F.W. Taylor’s and Henry Fayol’s Principles of Management – Functions of Manager – Directing – Leadership – Types of Leadership – Qualities of a good leader – Motivation – Positive and negative motivation – Modern management techniques- Management Information Systems – Strategic management – SWOT Analysis - Business Process Reengineering (BPR) – Enterprises Resource Planning (ERP) – Activity Based Management (ABM) – Global Perspective – Principles and brief description.
- **Personnel Management:** Responsibility of Human resource management – Selection procedure – Training of workers - Apprentice training – On the job training and vestibule school training – Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages - Wage fixation – Type of wage payment – Halsey’s 50% plan – Rowan’s plan and Emerson’s efficiency plan – Problems.
- **Organizational behaviour:** Definition – organization - Types of Organization – Line, Staff, Taylor’s Pure functional types – Line and staff and committee type – Organizational Approaches, individual behaviour - causes - Environmental effect - Behavior and Performance, Perception - organizational implications.

### Unit - 4

06

#### **Entrepreneurship Development:**

- **Introduction and process:** Entrepreneurship: Concept and Functions - Entrepreneur – Characteristics and qualities of an Entrepreneur – Functions of an Entrepreneur – Entrepreneurship: Need, Myths and Best Practices – Reasons for Failure of business – Financial schemes for Entrepreneurs – Calculation of unit of sale, unit price and unit cost – types of costs – Variable and fixed, operational costs – Break even analysis – Schemes for Technology assistance and Financial assistance.
- **Steps of conceiving and running an enterprise:** Business Plan Preparation – Business Idea – Evaluation – Making a Project Plan – Registration of enterprise – Funding of Enterprise – Setup of Enterprise – Sales & Marketing Planning – Running your Enterprise.

### Unit - 5

06

#### **Engineering Ethics and Human Values:**

- **Engineering Ethics:** Definition - engineering ethics - personal and business ethics - duties and rights - engineering as a profession - core qualities of professional practitioners - environment and their impact - code of ethics - procedure for solving ethical conflicts - ethical judgement - Kohlberg’s stages of moral development - value based ethics - engineers as managers, consultants and leaders - environmental ethics - computer ethics - Intellectual Property Rights (IPRs).
- **Human values:** Morals – values – integrity - service learning - civic virtue - respect for others - living peacefully - caring – sharing – honesty - courage - valuing time cooperation – commitments – empathy – self confidence – character - stress management

**References:**

1. Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications (P) Ltd – 2004, 67/4 Madras House, Daryaganj, New Delhi– 110002.
2. Industrial Engineering & Production Management – Martand Telsang Govindarajan .M, Natarajan. S, Senthikumar V.V, Engineering ethics, prentice hall of India New Delhi, 2004.
3. Management, Aglobal perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition. Latest.
4. Essentials of Management,4th Edition, Joseph L. Massie, Prentice - Hall of India, New Delhi 2004.

# BVTDM504

## PRODUCTION PLANNING AND COST ESTIMATION

### Course Objectives:

- The subject is intended to understand concepts, principles and procedure of production planning and cost estimation.
- The knowledge is acquired in learning the process planning, production control and elements of cost structure.
- The knowledge and skill is useful in designing tools and dies, production processes, workshop practice and industrial management.

### Unit - 1

06

#### Introduction:

#### Production and methods of production

- **Introduction:** To understand production and Methods of production.
- **Definition:** Concept of production system, inputs, manufacturing process, output.
- **Principles:** Principle of production system, job production, batch production, mass production.
- **Procedure:** Study of production system and method of production.
- Productivity:
- **Introduction:** Overview of productivity & its influence in industry.
- **Definition:** Concept of productivity, factors influencing productivity.
- **Principles:** Principles of productivity, productivity improvement.
- **Procedure:** Study production & productivity, factors influencing productivity.

### Unit - 2

06

#### Production Planning:

#### Stores & Inventory Control

- **Introduction:** Overview of stores and inventory control.
- **Definition:** Concept of storing, centralize and decentralize store, economical order quantity, ABC analysis, inventory control with respect to cost reduction, EOQ model.
- **Principles:** Principle of store layout and store management, economical inventory, ABC curve plotting, EOQ model.
- **Procedure:** Store and store function. Storing procedure. Documentation of store. Meaning and importance of inventory control.

#### Material Planning

- **Introduction:** Overview of material planning and its importance.
- **Definition:** Concept of material planning, master schedule, bill of material. Concept of inventory.
- **Principles:** Principles of material requirement planning, operating cycle.
- **Procedure:** Study importance of material planning. Information required for material planning.

### Process Planning

- **Introduction:** Overview of process planning and a process sheet.
- **Definition:** Concept of process planning, information required for process planning, economical sequencing, resources, and quality control.
- **Principles:** Principles of process planning, optimising sequence of operations, resources, quality control.
- **Procedure:** Preparation of working drawings. Selection of manufacturing process. Machine capacity & machine / equipment selection, operation planning & tooling requirement, preparation of documents such as operation & route sheets.

### Unit - 3

06

#### Production Control:

##### Routing and scheduling:

- **Introduction:** Overview of routing and scheduling phases of production control.
- **Definition:** Concept of Routing, scheduling, critical ratio scheduling, production control. Concept of charts.
- **Principles:** Principles of production control, scheduling, critical ratio scheduling, routing, generation of charts.
- **Procedure:** Importance and objective of scheduling, manufacturing methods and scheduling. Use of control charts in scheduling.

##### Loading, dispatching and follow-up

- **Introduction:** Overview of loading, dispatching and follow up process.
- **Definition:** Concept of loading, dispatching & follow up, job cards, progress card, auditing, value analysis.
- **Principles:** Principles of loading, dispatching & follow up, planning and replanning, tooling and gauges, utilization of man, machine & material, delivery schedules.
- **Procedure:** Procedure for loading, inspection, dispatching, follow up.

### Unit - 4

06

#### Elements of cost:

##### Cost structure:

- **Introduction:** Overview of cost elements and break even analysis.
- **Definition:** Concept of cost, fixed cost, variable cost, labour cost, material cost, prime cost, factory cost. Concept of break even analysis, graphical representation.
- **Principles:** Principles of cost, fixed cost, variable cost, labour cost, material cost, prime cost, factory cost. Principles of break-even analysis, graphical representation.
- **Procedure:** Explain various elements of cost, graphical diagram of cost structure, graphs of breakeven point.

##### Overheads & depreciation:

- **Introduction:** Overview of allocation of overheads and depreciation.
- **Definition:** Concept of overheads, sinking fund method, depreciation, straight line method.
- **Principles:** Principles of allocation of overheads & Depreciation, selection of method.
- **Procedure:** Procedure for calculating the overheads and allocation, calculating the depreciation cost.

**Unit - 5**

**Cost estimation:**

**Components of job estimation:**

- **Introduction:** Application of cost estimation.
- **Definition:** Concept of estimate and cost, pricing, profit and loss.
- **Principles:** Principles of realistic estimates, proper selection of machines & other resources, cost comparison, cost, profit & loss.
- **Procedure:** Explain various components of cost with. Reference to drawing. Describe components of job estimate.

**Estimating procedure and estimation of cost of component L P:**

- **Introduction:** Overview of estimating procedure
- **Definition:** Concept of reading drawings, manufacturing procedure, time estimation. Concept of estimation of cost, material cost, overhead cost.
- **Principles:** Principles of estimation, raw material estimation, selection of process planning, time estimation, overhead expenses.
- **Procedure:** List out elements of estimate, calculate the material cost, estimate time for each operation, add the overhead expenses. Find out the total estimated cost.

**References:**

1. O.P. Khanna, Industrial Engineering & Management, Dhanpat Rai Publishers, New Delhi
2. T.R. Banga, S.C. Sharma, Industrial Organisation & Engineering Economics Khanna Publisher, New Delhi

# **BVTDM505P**

## **INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP**

# SEMESTER-06

# BVTDM601

## PRODUCTION QUALITY MANAGEMENT

### Course Outcomes:

After taking this course, the students shall be able to:

- Identify the types of production & process planning for various industry in selection of process
- Elaborate the various tools and techniques related to Total Quality management
- Explain the various functions of production planning and control, total quality management
- List and describe the various types of management planning tools
- Demonstrate various chart and Statistical Fundamentals related to Quality management.
- List and explain the Lean Manufacturing Concepts.

### Unit - 1

06

#### Process Planning and Selection:

- **Production:** Types of Production – Mass production, batch production and job order production
- **Process Planning:** Introduction – concept – Information required to do process planning – factors affecting process planning – **Process Planning procedure** – Make (or) Buy decision using Break Even Analysis – simple problems. Manual process planning – Introduction of Automated process planning and generator process planning – Advantage of computer aided process planning – Principle of line balancing – need for line balancing – Value Engineering – Definition – cost control Vs cost reduction – value analysis when to do – steps information needed – selection of product.
- **Process Selection:** Process selection – technological choice – specific component choice – Process flow choice – Factors affecting process selection – machine capacity – analysis of machine capacity – process and equipment selection procedure – Determination of man, machine and material requirements – simple problems – selection of material – jigs – fixtures etc. – Factors influencing choice of machinery – selection of machinery – simple problems – Preparation of operation planning sheet for simple components

### Unit - 2

06

#### Basic Concepts of Total Quality Management:

Quality-Definitions – Dimensions of quality – Brainstorming and its objectives – Introduction to TQM – Characteristics – Basic concepts – Elements - Pillars – Principles – Obstacles to TQM implementation – Potential benefits of TQM - Quality council – duties – Responsibilities - Quality statements – Vision – Mission – Quality policy statements – Strategic planning – Seven steps to strategic planning – Deming philosophy – Customer – Input / Output process model – Juran Trilogy - PDCA (Deming Wheel) cycle.

### Unit - 3

06

#### TQM Tools:

- **Seven tools of quality control (Q 7 tools):** Check sheet – Types of check sheet – Histogram – Cause and effect diagram – Pareto diagram – Stratification Analysis – Scatter diagram-Graph/run charts – Control charts – Construction of above diagrams. Quality circle – concept of quality circle – Organisation of Quality circle and objectives of Quality circle. Zero Defect Concepts.
- **Management Planning Tools (M 7 Tools) Affinity diagram** – Radar Diagram – Inter Relationship diagram (Inter Relationship diagram) – Tree diagram – Prioritization matrix – Matrix diagram – Decision tree – Arrow diagram – Matrix data analysis diagram – Construction of above diagrams.

### Unit - 4

06

#### Statistical Fundamentals and Control Charts:

- **Types of Data** – Collection of Data – Classification of Data – Tabular presentation of Data - Graphical representation of a frequency distribution – Comparison of Frequency distribution – Mean - Median – Mode – Comparison of measures of central tendency - Introduction to measures of dispersion – Sample – sampling – Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems.
- **Control chart** – Types of control charts – Control chart for variables – Construction of X bar and R charts – control limits Vs specification limits – Process capability – Method of doing process capability Analysis – Measures of process capability – Problems.
- **Attributes** – Control charts - P chart – np chart – c chart – u chart – Construction of above diagrams – Problems – Comparison between variable chart and Attribute chart. .

### Unit - 5

06

#### Lean Manufacturing Concepts:

- 5S Concepts (SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE) – Needs and objectives – effective implementation of 5S concepts in an organisation – Housekeeping – Kaizen – Kanban System. Bench marking - Objectives of bench marking – Types – Benchmarking process – Benefits of Bench marking – Pit falls of Benchmarking-Just In Time (JIT) concepts and its objectives – Total Productive Maintenance(TPM) – Introduction, Objectives of TPM –steps in implementing TPM. – Overall Equipment Effectiveness ( OEE)–Lean Six Sigma – Value Stream Mapping – DMAIC(Define, Measure, Analyse, Improve, Control) – DMADV (Define , Measure, Analyse, Design, Verify)

**References:**

1. Industrial Engineering & Management – O.P Khanna
2. Industrial Engineering & Production Management – Mart and Telsang
3. Total Quality Management, Date H.Besterfiled, Pearson Education Asia.
4. Total Quality Management, V.Jayakumar, Lakshmi Publications. (reprint 2005)
5. Training manual on ISO 9001: 2000 & TQM, Girdhar J.Gyani, Raj Publishing House, Second Edition 2001
6. Quality Management, Howard Cuitlow, Tata Mc Graw Hill, 1998
7. Production Engineering – P.C.Sharma.
8. Production and Costing – GBS Narang and V.Kumar
9. Mechanical Estimating and Costing – Banga & Sharma.
10. Total Quality Management, Oakiand. J.S. Butterworth Heinemann Ltd. Oxford 1989.
11. Quality Management – Concepts and Tasks- Narayana.V and Sreenivasan. N.S., New Age International 1996.
12. Total Quality Management for engineers, Zeiri. Wood Head Publishers. 1991.
13. Quality Planning and Analysis, Juran J.M and Frank M.Gryna Jr. TMH India. 1982
14. ISO 9001, Brain Rethry, Productivity and Quality Publications.

# BVTDM602

## SMART TECHNOLOGIES

### Course Outcomes:

After taking this course, the students shall be able to:

- Understand the principle and mechanical engineering applications of Industry 4.0 and IOT
- Understand the mechanical engineering applications of Block chain Technology and Artificial Intelligence
- Compare working principle of 3D printing and 4D Printing
- Explain the mechanical engineering applications of augmented reality and Virtual Reality
- Outline the applications of Digital twins, Smart Sensors, and Smart factories in manufacturing industries
- Explain the principles of Smart Engineering and Smart Manufacturing

### Unit - 1

06

#### Industry 4.0 and Internet of Things:

- **Industry 4.0:** Introduction – History behind Industry 4.0 – Components of Industry 4.0 – Industry 4.0 Design Principles – Benefits and Challenges of Industry 4.0 – Future of Industry 4.0.
- **Internet of Things:** Introduction – History – Working of IoT – IoT applications – Challenges – Advantages – Disadvantages – Best Practices – Applications - Industrial internet of things (IIoT) – IIoT Architecture – Application of IOT in Manufacturing and Automotive Industry.

### Unit - 2

06

#### Block Chain Technology and Artificial Intelligence:

- **Block Chain Technology:** Introduction –Types – Architecture - Working of Block Chain – Benefits of BlockChain – Disadvantages – Applications in Mechanical Engineering
- **Artificial Intelligence:** Introduction to Artificial Intelligence (AI) – Levels of AI – History of AI – Type of AI – Machine Learning – Deep learning – AI vs ML – Applications of AI – Mechanical Engineering applications of AI.

### Unit - 3

06

#### 3D Metal Printing & 4d Printing and Augmented Reality/Virtual Reality:

- **3D Metal Printing & 4 D Printing:** Introduction - Selective Laser Melting (SLM) - Direct Metal Laser Sintering (DMLS) – Working of Metal 3D Printing – Benefits and Limitations of 3D Printing – Introduction to 4D Printing – Difference between 3D printing and 4D Printing.
- **Augmented Reality/Virtual Reality:** Augmented reality (AR) – Virtual reality (VR) – Working of AR – Working of VR – Difference between AR & VR – Advantages of AR & VR – Disadvantages of AR & VR – Applications of AR & VR – Mechanical Engineering applications.

#### Unit - 4

06

##### **Digital Twins, Smart Sensors and Smart Factory:**

- **Digital Twins:** Introduction – Working - Applications – Benefits – Types –Applications in Manufacturing and Automotive Industry.
- **Smart sensors and smart Factory:** Smart Sensor – Introduction – Working – Architecture - types of sensors - Benefits – Applications in manufacturing industries. Introduction to Smart Factory – Benefits – Levels – Technologies used in smart factory.

#### Unit - 5

06

##### **Smart Engineering and Design, Smart Manufacturing:**

- **Smart Engineering and Design:** Smart Engineering – Levers of smart Engineering – Industrial revolutions and smart design Engineering – Designing for empowered users - Design for productin-use feedback - Design for changeability - Design for data analytics - Design for cyber security - Design for emotional interaction - Product Representation and Exchange Technologies and Standards.
- **Smart Manufacturing:** Introduction – Difference between smart manufacturing and Traditional Manufacturing – Automated storage and retrieval system – Computer Aided Quality Control – Agile Manufacturing – Principle of Agile manufacturing – Implementation of Agile manufacturing – Applications.

##### **References:**

1. Tiana Laurence, “Introduction to Blockchain Technology”, ISBN:9789401805049, 9401805040, Van Haren Publishing, 2019.
2. K. R. Chowdhary, “Fundamentals of Artificial Intelligence”, ISBN:9788132239727, 8132239725, Springer India, 2020.
3. John O. Milewski, “Additive Manufacturing of Metals”, ISBN:9783319582054, 3319582054, Springer International Publishing, 2017.
4. Rupinder Singh, “4D Printing Fundamentals and Applications”, ISBN:9780128237250, 0128237252, Elsevier Science, 2022.
5. Oliver Grunow, “Smart Factory and Industry 4.0. The Current State of Application Technologies”, ISBN:9783668271043, 3668271046, Studylab, 2016.

# BVTDM603

## ADVANCED PRESS TOOLS AND DIES

### Course Outcome:

- The course inculcates student's presses and dies used to give final shape to the parts being produced in industry.

### Unit - 1

06

#### Presses, Compound Dies & Inverted Dies:

Press Working Terminologies, construction and types of presses-mechanical & automatic, Computation of press capacity, Introduction to Inverted Dies, construction and function of various parts of Inverted dies, Compound dies, function of various parts of Compound dies, Design of compound and Inverted Dies.

### Unit - 2

06

#### Principles of Blanking and Piercing Dies:

Basic Blanking or piercing operation, Shearing Theory, calculation of cutting force and stripping force, importance of cutting force, calculation of press tonnage, calculation of cutting clearance, importance of cutting clearance. Method of reducing the cutting force.

### Unit - 3

06

#### Introduction to various parts of Blanking and Piercing Dies:

Function, types and construction of Punches, Punch Plate, Die Plate, stripper plate, Top Plate, Shank, Guide pillar, Guide Bushes, gages, Stock guides, Die stops, Nest Gages and Pushers, Stock material utilization and strip layouts. types of Die Sets,

### Unit - 4

06

#### Designing of Shearing Tools:

Design of blanking, Piercing Dies, Clearance and corner radii.

### Unit - 5

06

#### Introduction and Design of Bending Dies:

Basic of Bending, bending stress, bend allowance curve, estimating Flat Blank lengths, Introduction to Bending Dies to produce V,L and U shaped Bend components, Grain direction, Spring back effect, calculation of bending force and pad force, Design of Bending Dies.

### References:

1. Cyril Donaldson and V. C. Goold, "Tool Design", TMH
2. Ostergaard, "Advance Die Making", MGH, New York, 1993.
3. P.H. Joshi, "Press Tool Design and Construction", Wheeler Publishing, Delhi, 2000
4. Vukota Boljanovic, "Sheet Metal Stamping Dies: Die Design and Die-Making Practice", Industrial Press, Inc. New York, NY, USA

# BVTDM604

## INJECTION MOULD DESIGN AND ANALYSIS

### Unit - 1

08

#### Introduction to Injection Molding and Mold Design:

- **Overview of Injection Molding:** This includes the process of melting plastic and injecting it into a mold to create a part.
- **Mold Design Fundamentals:** Covers the basic components of an injection mold, such as the cavity and core, sprue, runners, and gates.
- **Material Selection:** Understanding different plastic materials and their properties relevant to injection molding, including factors like shrinkage and material behavior.
- **Types of Molds:** Exploring various mold configurations, including single-cavity, multi-cavity, and specialized molds.
- **Mold Design Considerations:** Factors like draft angles, parting lines, shut-off angles, and material shrinkage are discussed.
- **CAD Modeling:** Using software like CATIA V5 or UG-NX to create 2D and 3D models of the mold and the molded part.
- **Mold Manufacturing Process:** Understanding the steps involved in manufacturing the mold, from design to machining and finishing.

### Unit - 2

08

#### Mold Components and Functionality:

- **Sprue, Runner, and Gate Design:** Detailed analysis of these components and their roles in directing molten plastic into the mold cavity.
- **Cooling Systems:** Design and analysis of cooling channels within the mold to control temperature and ensure proper part cooling.
- **Ejection Systems:** Understanding the mechanisms for ejecting the finished part from the mold.
- **Venting:** Designing vents to allow air to escape during injection and prevent defects.

### Unit - 3

07

#### Mold Analysis Techniques:

- **Flow Analysis:** Using software to simulate the flow of molten plastic within the mold, identifying potential issues like short shots, air traps, and weld lines.
- **Cooling Analysis:** Analyzing the cooling process to optimize the cooling system and minimize cycle time.
- **Warp Analysis:** Predicting and minimizing warpage and deformation of the molded part.
- **Stress Analysis:** Evaluating the stress distribution within the mold and the molded part.
- **Gate Location Analysis:** Determining the optimal gate locations for even filling and minimal defects.

**Advanced Topics:**

- **Multi-cavity Mold Design:** Designing molds with multiple cavities to increase production efficiency.
- **Hot Runner Systems:** Understanding the design and functionality of hot runner systems for efficient material delivery.
- **Mold Defect Analysis and Solutions:** Identifying common mold defects and implementing solutions.
- **Computer-Aided Engineering (CAE):** Utilizing software for mold flow analysis and simulation.

**BVTDM605P**  
**INDUSTRIAL TRAINING/ON JOB TRAINING/  
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