PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

Subject Title	Subject Code	Credits			Theory		
		L	T	P	External (70)	Internal (30)	Total (100)
Power Plant Engineering	MET-601	3	1	-			Min: 40 (D Grade)

Duration of Theory (External): 3 Hours
Theory Internal - Max Marks: 30

Best of Two Mid Semester Test –Max Marks: 20
Assignment / Quiz – Max. Marks: 10

Unit	Contents (Theory)
I	**Introduction:** General Sources of power, Importance of Central Power Stations, Types of power stations – steam, Nuclear, Diesel and hydro – Elements of modern thermal power stations, brief layout and arrangement of elements and complements, Sitting layout of different power stations, Foundation, Elements of Electric power systems primary and secondary distribution substations.
II	**Thermal Power Plant:** Steam power plants selection of working medium, Heat Balance in steam cycles, Heat rates, Comparison of efficiencies gas loop, Fuels and fuel handling System and Ash handling System ,Air pre-heater, Feed water pre-heaters, Steam re-heaters, Deaerators, Feed water treatment, Pumping and regulation water walls, steam boilers, cooling tower, Important instrumentation and piping of gas and water loop. Factors to be controlled from maximum efficiency and variable output.
III	**Nuclear Power Station:** Evolution of nuclear energy from atoms by fission and fusion, Chain reactions, Fission materials, Types of reactors, gas cooled, Boiling water liquid, Metal cooled and fast reactor, Arrangements of various elements in a nuclear power station, Steam cycles and boilers coolant heat exchangers, Reactor control, Reactor shielding and safety methods.
IV	**Hydro Electric power station** – Potential power with reference to rainfall and catchments area, Water storage, Equipment used in hydro electric power stations, Characteristics of hydraulic turbines, Comparison of the factors governing the cost of hydro steam and diesel power stations. **Non Conventional Power Plant**: principal selection features and layout of Solar, wind, tidal, geothermal, ocean, bio energy.
V	**Variable load problems:** Idealized and realized load curves, Effect of variable load on plant design and Operation variable load operation and load dispatch. **Power station Economics:** Source of income, Cost of plant and production, Elements of cost, depreciation and replacement theory of rates.

References:

1. Power Plant Engineering, 2nd Edn. – P.K. Nag – Tata McGraw-Hill Pub. Com., New Delhi,
2. A Text Book of Power Plant Engineering – R.K. Rajput – Laxmi Publications
3. A Course in Power Plant Engineering – Arora, Domkundwar – Dhanpat Rai & Co.,
4. Power Plant Engineering – F.T. Morse Affiliated East – West Press Pvt. Ltd., New Delhi.
5. Power Plant Technology – M.M. E1 – Wakil – McGraw Hill, International Edition
6. Power Plant Engineering – G.R.Nagpal – Khanna Publishers.

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

Subject Title	Subject Code	Credits			Theory		
		L	T	P	External (70)	Internal (30)	Total (100)
Production Planning and Control	MET- 602	3	1	-			Min: 40 (D Grade)

Duration of Theory (External): 3 Hours
Theory Internal - Max Marks: 30
Best of Two Mid Semester Test -Max Marks: 20
Assignment / Quiz - Max. Marks: 10

Unit	Contents (Theory)
I	**Production Management:** Definition, Objectives, Scope, Benefits, Functions of production management, Place of production management in an organization, Types of production system, Product life cycle, Product design and development, production cycle. **Costing and Cost Analysis:** Elements of costs Break even analysis, Incremental costs, decision, **Sales Forecasting:** Purposes, Methods – Delphi, Linear regression, Economic indicators, Time-series analysis, Moving average, Exponential smoothing.
II	**Inventory models**: Necessity of inventory in process and safety stock, problem of excess inventory and cycle time (=WIP/ Throughput), JIT/ lean mfg; basic EOQ/ EPQ models for constant review Q-system(S,s); periodic review, base stock P-system; service level, lead time variance and safety stock;; ABC, VED and other analysis based on shelf life, MRP technique and Calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP ,& ERP. Inventory control under risk and uncertainty.
III	**Production Planning and Control** : Functions, Organization, Master Scheduling, Aggregate planning and strategies, Materials requirement planning, Product structure tree, Routing, Loading, Scheduling – forward and backward, Dispatching – priority rules, Sequencing, Gantt's Chart, Bar chart, Flow process chart.
IV	**Material Management:** Objectives and functions of materials management, Organization of materials management, MRP I and MRP II. **Materials Handling:** Principles of materials handling, Unit load, Types of materials handling equipment, Relation between materials handling and plant layout.
V	**Procurement:** Objectives of purchase department, Purchase responsibilities and organization, Types of purchasing, Purchase procedures, Import and Export. **Stores Keeping:** Stores management, Functions of stores, Classification of materials, Standardization of materials, Identification and maintenance of layout of stores, Physical control of materials, Pricing of stores, Issuing of stores. **Supply Chain Management:** Introduction, Definition of supply Chain, Major derivers of supply chain, Supply Chain Strategies, A model for strategy formulation in SCM. Information Systems in supply chain.

References:

1. Production and operation Management – By P. Ramamurty – New Age International Publication.
2. Industrial Engineering & Production Management – Martand Telsang – S. Chand & Co.,
3. Supply Chain Management – R.P. Mohanty & S G Deshmukh, SBiztantra Publications.
4. Production and operation Management – By R. Mayer – Tata McGraw Hill publication.
5. Quality Planning and Analysis, Juran and Gryna
6. Production and operations Management by – Adam and Ebert – PHI –

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total (50)
Machine Design - I	MET-603	3	1	2	(70)	(30)	Min: 40 (D Grade)	(35)	(15)	Min: 20 (D Grade)

Duration of Theory (External): 3 Hours

Theory Internal - Max Marks: 30

Best of Two Mid Semester Test –Max Marks: 20

Assignment / Quiz – Max. Marks: 10

Practical Internal - Max Marks: 15

Lab work & Sessional –Max Marks: 10

Assignment / Quiz – Max. Marks: 05

Unit	Contents (Theory*)
I	**Stress concentration and fatigue:** causes of stress concentration; stress concentration in tension, bending and torsion; reduction of stress concentration, theoretical stress concentration factor, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage factor.
II	**Riveted Joints:** Types of rivet heads, Types of riveted joints, Failure of riveted joint, Strength of rivet joint, Efficiency of riveted joint, Design of riveted joint, Eccentrically loaded riveted joint. **Welded joint:** Types of welded joints, Stresses in butt and fillet welds, Strength of welded joints, Location and dimension of weld design, Eccentrically loaded joint, Welded joint subjected to bending moment, Design procedure, Stress relieving techniques. **Springs**: Design of helical compression and tension springs, leaf springs and torsion springs; fatigue loading of springs, surge in spring;
III	**Basic Elements Design**: Introduction of Shafts, Design of shaft under combined bending, twisting and axial loading; shock and fatigue factors, design for rigidity; Design of shaft subjected to static &dynamic load; Design of keys and shaft couplings, muff, flange, flexible etc.
IV	**Brakes & Clutches:** . Design of brakes: Rope, band & block brake, Internal expending brakes, Disk brakes, Materials for friction surface, uniform pressure and uniform wear theories, Design of friction clutches: Disk, plate clutches, cone & centrifugal clutches
V	**Journal Bearing:** Types of lubrication, viscosity, hydrodynamic theory, design factors, temperature and viscosity considerations, Reynolds's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers, Design of journal bearings, **Rolling-element Bearings:** Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

NOTE: *Machine Design data books permitted in the examination hall.

References:

1. Machine Design by-J.E. Shigly-McGraw Hill Publications.
2. Design of Machine Elements from V.B. Bhandari, TMH Publications.
3. Machine Design – P.C.Sharma & D.K. Agrawal-Kataria & Sons Publications.
4. Principles of Mechanical Design - R. Phelan – McGraw Hill Pub.
5. Machine Design - An Integrated Approch Robert-L-Norton Published by Addison Wesley Longman
6. Machine Design – M. F. Spott – PHI
7. Machine Design by-J.E. Shigly-McGraw Hill Publications.

List of Experiments (Expandable/Suggested)::

Designing and sketching of components contained in the syllabus.

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External (35)	Internal (15)	Total (50)
Refrigeration & Air Conditioning	**MET-604**	3	1	2			Min: 40 (D Grade)			Min: 20 (D Grade)

Duration of Theory (External): 3 Hours

Theory Internal - Max Marks: 30

Best of Two Mid Semester Test –Max Marks: 20

Assignment / Quiz – Max. Marks: 10

Practical Internal - Max Marks: 15

Lab work & Sessional –Max Marks: 10

Assignment / Quiz – Max. Marks: 05

Unit	Contents (Theory)
I	**Introduction**: Principles and methods of refrigeration, freezing; mixture cooling by gas reversible expansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.
II	**Vapour compression system**: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquification system. Refrigeration Compressors,
III	**Vapour absorption system**: Theoretical and practical systems such as aqua-ammonia, Electrolux & other systems; **Steam jet refrigeration**: Principles and working, simple cycle of operation, description and working of simple system; **refrigerants:** nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties.
IV	**Psychrometric**: Calculation of psychometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body.
V	**Air conditioning loads**: calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

References:

1. Arora C.P.; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI
3. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
4. Ameen; Refrigeration and Air Conditioning; PHI
5. Pita ; Air conditioning Principles and systems: an energy approach; PHI
6. Stoecker W.F, Jones J; Refrigeration and Air conditioning; TMH.
7. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

List of Experiments (Expandable/Suggested):

1. General Study of vapor compression refrigeration system.
2. General Study of Ice Plant
3. General Study and working of cold storage
4. General Study Trane Air Condition (Package Type).
5. General Study of Electrolux Refrigeration
6. General Study One tone Thermax refrigeration unit.
7. General Study of Water cooler
8. General Study of Psychrometers (Absorption type)
9. General Study of Leak Detectors (Halide Torch).
10. General Study and working of Gas charging Rig.
11. General Study of window Air Conditioner.
12. General Study and working of Vapor compression Air conditioning Test rig.
13. Experimentation on Cold Storage of Calculate COP & Heat Loss.
14. Experimentation on Vapor compression Air Conditioning test rig.
15. Changing of Refrigerant by using Gas Charging Kit.

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total (50)
Machine Tools and Operations	MET-605	3	1	2	(70)	(30)	Min: 40 (D Grade)	(35)	(15)	Min: 20 (D Grade)

Duration of Theory (External): 3 Hours

Theory Internal - Max Marks: 30

Best of Two Mid Semester Test –Max Marks: 20

Assignment / Quiz – Max. Marks: 10

Practical Internal - Max Marks: 15

Lab work & Sessional –Max Marks: 10

Assignment / Quiz – Max. Marks: 05

Unit	Contents (Theory)
I	**Introduction:** cutting motion in machine tools, requirements, characteristics, process capability of machine tool, elements of machine tool, kinematics of machine tool drives, hydraulic and electric drives, gear box, standardizations of machine tool drives, vibrations of machines, dynamics rigidity, chip disposal, maintenance of machine tool.
II	**Theory of Metal Cutting:** Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation. Desired properties and types of cutting tool materials. Cutting fluids, function of cutting fluid, types of cutting fluid. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.
III	**Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.
IV	**Lathe** : size, specifications, operations-facing, turning, knurling, taper turning, thread cutting, drilling, chamfering, boring, reaming, work holding devices & tools, mechanism and attachments for various operations. Planning operations, operation performed on shaper machine. Numericals based on cutting speed, material removal rate, depth of cut etc.
V	**Reaming & Boring**: Principle of operation, parts and types of operations, tools. Numericals based on cutting speed, material removal rate, depth of cut etc. **Grinding**: Processes, machines, design consideration for grinding, specification of grinding wheel, process parameters and economics of grinding.

References:

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill, New Delhi
2. A Text Book of Production Technology (Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi.
3. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
4. Production Technology – R.K. Jain – Khanna Publishers, New Delhi
5. A Text Book of Production Technology (Vol. I & II) – O.P. Khanna ,Dhanpat Rai & Sons, New Delhi.

List of Experiments (Expandable/Suggested):

1. Study of various types of machine tool.
2. Study of various types of cutting tool.
3. Study of mechanism of chips formations.
4. Study of tool failure.
5. study of linear measuring instruments
6. study of angular measuring instruments
7. Study of various types of operations performed on lathe machine.
8. Study of various types of operations performed on shaper machine.
9. Study of various types of operations performed on milling machine.

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

10. Study of various types of operations performed on grinding machine.

Subject Title	Subject Code	Credits			Practical		
		L	T	P	External	Internal	Total (50)
Professional Skills –III	BT- 606	-	-	2	(Nil)	(50)	Min: 20 (D Grade)

Practical Internal - Max Marks: 50

Lab work & Sessional – Max Marks: 45

Assignment / Quiz – Max. Marks: 05

Contents
Group discussion Introduction to group discussion, structure and dynamics; Techniques of effective participation in group discussion; Preparing for group discussion; Ways to carry out group discussion, Parameters— Contact, body language, analytical and logical thinking, decision making **Interview Technique** Necessity, How to prepare for interviews; Language and style to be used in interview; Types of interview questions and how to answer them; Tips for handling common questions.

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

Subject Title	Subject Code	Credits			Practical		
		L	T	P	External	Internal	Total (50)
Research Methodology	BT- 607	0	0	2	(Nil)	(50)	Min: 20 (D Grade)

Practical Internal - Max Marks: 50

Lab Performance, Lab Record & Viva –Max Marks: 45

Assignment / Quiz – Max. Marks: 05

Unit	Contents *(Practical)*
I	**Objectives and types of research:** Motivation and objectives – Research methods *vs* Methodology. Types of research – Descriptive *vs*. Analytical, Applied *vs*. Fundamental, Quantitative *vs*. Qualitative, Conceptual *vs*. Empirical.
II	**Research Formulation** – Defining and formulating the research problem - Selecting the problem Necessity of defining the problem - Importance of literature review in defining a problem.
III	**Research design and methods** – Research design – Basic Principles- Need of research design Features of good design – Important concepts relating to research design – Observation and Facts. Developing a research plan - Exploration, Description, Diagnosis, and Experimentation.
IV	**Data Collection and analysis:** Execution of the research - Observation and Collection of data Methods of data collection – Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-testing - Generalization and Interpretation.
V	**Reporting and thesis writing** – Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes.

References:

1 Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.

2 Kothari, C.R., 1990. *Research Methodology: Methods and Techniques*. New Age International. 418p.

3 Sinha, S.C. and Dhiman, A.K., 2002. *Research Methodology*, Ess Ess Publications. 2 volumes.

4 Trochim, W.M.K., 2005. *Research Methods: the concise knowledge base*, Atomic Dog Publishing. 270p.

5 Wadehra, B.L. 2000. *Law relating to patents, trade marks, copyright designs and geographical indications*. Universal Law Publishing.

PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -VI**

Subject Title	Subject Code	Credits			Practical		
		L	T	P	External (35)	Internal (15)	Total (50)
RDBMS	BT-638	-	-	2			Min: 20 (D Grade)

Practical Internal - Max Marks: 15

Lab work & Sessional –Max Marks: 10

Assignment / Quiz – Max. Marks: 05

Unit	Contents *(Practical)*
I	DBMS an overview, Advantages of DBMS Network, Hierarchical and Relational Model, Levels of abstraction, Data Independence, Data Models, Instances and schemes, Data independence, Structures of a DBMS, Application Programmers & Data Base administrators – their function, Transaction Management ,Entity Relationship Model- Entities, Attributes and Entity Sets, Relation and Relationships sets, Features of E-R Model
II	Relational Model Introduction, Integrity constraints over relations, Enforcing Data Integrity, Integrity Constraints, Relational Data, Logical Data Base Design, E-R to relational, Introduction to views, Querying, Relational Algebra and Relational Calculus, Operations on Relational Algebra, Operations on Relational Calculus, Tuple Relational Calculus, Domain Relational Calculus
III	Meaning of integrity constraints, various types of integrity constraints in relational approach like domain constraints, referential integrity constraints, functional dependency constraints, assertions, triggers etc. Normalization in relational approach, conversion of a relational to higher normal forms, normalization using functional dependencies, multi-valued dependencies, join dependencies etc., domain key normal form.
IV	Methods of storing relational database record in files, various types of files like sequential files, indexed files, indexed sequential files etc. for storing of relational data, buffer management, data dictionary, physical storage media etc. needed for these file. Introduction to indexing and hashing, various types of indexing techniques using B -Trees, B+ -Trees etc., various types of hashing techniques like static hashing function, dynamic hashing function etc, overview of query processing and cost estimation.
V	Overview of object oriented databases and related concepts, object relational model, distributed databases, parallel databases, temporal databases, spatial databases, web & multimedia databases.

References:

1. Fundamentals of Database Systems by Elmasri & Navathe
2. Database System Concepts by Silberschatz , Korth & Sudershan .
3. An introduction to Database Systems by C.J.Date

List of Experiments (Expandable/Suggested):

1. Study and Implementation of Create table Command
2. Study and Implementation of Insert Command
3. Study and Implementation of Delete Command
4. Study and Implementation of Drop Table Command
5. Study and Implementation of Alter Table Command
6. Study and Implementation of Update Command
7. Study and Implementation of Select Clause
8. Study and Implementation of From Clause
9. Study and Implementation of Where Clause
10. Delete Duplicate Rows from the Table