

**UTTRAKHAND TECHNICAL UNIVERSITY, DEHRADUN**  
**STUDY & EVALUATION SCHEME**

**B. Tech. Industrial & Production Engineer**  
 (Effective from the session: 2008-09)

**YEAR II**

**SEMESTER-IV**

S. No.	Course Code	SUBJECT	PERIODS				Evaluation Scheme			Subject Total
			L	T	P	CT	SESSIONAL		ESE	
							EXA	Total		
<b>THEORY</b>										
1.	TIP-401	ELECTRICAL ENGG	3	1	0	30	20	50	100	150
2.	TIP-402	MEASUREMENTS & METROLOGY	3	1	0	30	20	50	100	150
3.	TIP-403	PRODUCTION ENGG.	3	1	0	30	20	50	100	150
4.	TIP-404	THEORY OF MACHINE	3	1	0	30	20	50	100	150
5.	TIP-405	PROJECT MANAGEMENT	3	1	0	30	20	50	100	150
<b>PRACTICAL/TRAINING/PROJECT</b>										
6.	PIP-451	ELECTRICAL ENGG Lab	0	0	2	-	25	25	25	50
7.	PIP-452	MEASUREMENTS & METROLOGY Lab	0	0	2	-	25	25	25	50
8.	PIP-453	PRODUCTION ENGG.- Lab	0	0	2	-	25	25	25	50
9.	PIP-451	General Proficiency	-	-	-	-	-	-	-	100
10.	GP-452	Discipline	-	-	-	-	-	-	-	100
		<b>Total</b>				-	-	-	-	<b>1100</b>

## Electric Machines

TIP401

**Unit – I :Transformers:** Construction, polarity test, Sumpners test, all day efficiency. Autotransformer: Volt-amp relation, efficiency, advantages & disadvantages and applications; Three-phase transformers: Connections, threephase bank of single phase transformers, Scott connections; Instrument Transformers. **8**

**Unit – II : D.C. Machines:** D.C.machine: Construction, emf and torque equations. Armature reaction, commutation, performance characteristics of motors and generators, starting of motors, speed control losses and efficiency. **8**

**Unit – III: Fractional H.P. Motors:** Single phase induction motor: Construction, revolving field theory and principle of operation, equivalent circuit and starting methods. Two-phase servo-motor, stepper motor, and their applications. Industrial Applications :Concept of braking in dc and ac motors, two quadrant and four quadrant operation of dc and three phase induction motors, industrial applications of dc and ac motors. **7**

**Unit IV : Three-Phase Induction Motor:** Construction, rotating magnetic field and principle of operation, of equivalent circuit, torque production, Torque-slip characteristics, speed control, starting of squirrel cage and slip ring induction motors.

**Unit V : Three-phase Synchronous Machines:** Three-phase Synchronous Machines :Alternator: Construction, emf equation & effects of pitch and distribution factors phase diagram, armature reaction, Voltage regulation and its determination by synchronous impedance method, methods of synchronization Synchronous motor: Principle of operation and starting torque and mechanical power developed, effect of excitation on line current, (v curves).

## Measurements & Metrology

T I P 402

**Unit-I: Mechanical Measurements:** Introduction : Introduction to measurement and measuring instruments, Generalised measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors. Sensors and Transducers: Types of sensors, types of transducers and their characteristics. Signal transmission and processing: Devices and systems. Signal Display & Recording Devices.

**Unit-II: Sensors and Transducers:** Types of sensors, types of transducers and their characteristics. **Signal transmission and processing:** Devices and systems. Signal Display & Rcocring Devices.

**Unit-III: Time related measurements:** Counters, stroboscope, frequency measurement by direct comparison.Measurement of displacement. Measurement of pressure: elastic and indirct type pressure transducers, Measurements of very low pressures. Strain measurement: Types of strain gauges and their working, strain gauge circuits, temperature compesation, Strain rosettes, calibration.

**Measurements of force and torque:** Different types of load cells, elastic transducers, pneumatic & hydraulic systems.

**Temperature measurement:** By thermometers, bimetallic, thermocouples, thermistors and pyrometers.

**Unit-iv: Metrology:** Metrology and Inspection: Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability and standarisation. Linear and

angular measurements devices and systems Comparators: Sigma, Johanssos Microkrator. Limit gauges classification, Taylors Principle of Gauge Design.

**Unit-V** : Measurement of geometric forms like straightness, flatness, roundness. Tool makers microscope, profile project autocollimator.

Interferometry : principle and use of Interferometry. surface texture Quantitative evaluation of surface roughness and its measurement.

**Refefence:**

1. Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House, N. Delhi.
2. Doeblein E.O."Measurements Systems, Application Design", Mc Graw Hill,
3. Doeblein E.C. "Mechanical Measurements and Control", Metropolitan, N. Delhi.
4. Hume K.J., "Engineering Metrology", MacDonald and Co. 1963
5. Gupta, I.C. "Engineering Metrology", Dhanpat Rai & Sons, New Delhi, 1994
6. Sirohi, "Mechanical Measurements" New Age Publishers
7. Jain R.K. "Engineering Metrology" Khanna Publishers
8. Jain R.K. "Engineering Metrology" Khanna Publishers

## Production Engineering

T I P 403

**Unit – I:**

**Introduction:** Importance of manufacturing. Economic & technological considerations in manufacturing. Survey of manufacturing processes. Materials & manufacturing processes for common items.

**Unit- II**

**CASTING (foundry):** Basic principle & survey of casting processes, Types of patterns and allowances. Types and properties of moulding sand. Elements of mould and design considerations, gating, riser, runners, core. Solidification of casting, theory and analysis. Sand casting. Defects & remedies and inspection. Cupola furnace. Die Casting centrifugal casting. Investment casting etc.

**Unit- III**

**Metal Joining (Welding)** Survey of welding and allied processes, Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding- spot, seam projection etc. arc, electroslag, friction welding. Soldering & Brazing.

**Unit- IV**

Machine Tools

1. Lathe: Principle, types, operations, Turret/capstan, semi/Automatic, Tool layout.
2. Shaper, slotter, planer: operations & drives.
3. Milling : Milling cutters, up & down milling, Dividing head & indexing. Max chip thickness & power required.
4. Drilling and boring : Drilling, boring, reaming tools. Geometry of twist drills.

**Books:**

1. Manufacturing Science by Ghosh and Mallik Production Engg. Science by P.C. Pandey

## Theory of Machine

T I P 404

**Unit – I :** Introduction : Links-types, Kinematics pairs-classification, Constraintstypes, Degree of Freedom, Grublers equation, linkage mechanisms, inversions of four bar linkage, slider crank chain and double slider crank, Velocity in Mechanisms Velocity of point in mechanism, relative velocity method, instantaneous point in meechanism, Kenneds theorem, instantaneous center method.

**Unit – II : Cams and Followers** - Classification & terminology, Cam profile by graphical methods for uniform velocity, simple harmonic motion and parabolic motion of followers, Analytical cam design tangent and circular cams. **Mechanical Vibration:** Single degree free & forced, Undamped & Damped vibrations, Critical speeds.

**Unit – III: Gears:** Classification & terminology, law of gearing, tooth forms, interference, under cutting, minimum number of teeth on gear and pinion to avoid interference, simple, compound and planetary gear trains. **Balancing of machines:** Static and dynamic balancing, Balancing of rotating and reciprocating masses, Primary and secondary forces and couples.

**Unit – IV: Governors:** Dead weight and spring loaded governors, Sensitivity, Stability, Hunting, Isochronism, Effort and Power, Friction and Insensitivity, Introduction to inertia governors.

**Unit – V: Gyroscopic Motion:** Principles, Gyroscopic acceleration, Gyroscopic couple and Reaction. Effect of gyroscopic couple upon the stability of aeroplanes, ship, two & four wheelers.

### Books and Reference:

1. Theory of machines-Thomas Bevan
2. Theory of Machines and Mechanisms- Shigley
3. Theory of machines and mechanisms-Ghosh & Mallik
4. Theory of machines and mechanisms- Rao & Dukkipati
5. Theory of machines-R.K. Bansal
6. Theory of machines- V.P. Singh
7. Theory of machines- Malhotra & Gupta
8. Theory of machines- Khurmi & Gupta
9. Mechanics of Machines- V.Ramamurt

## PROJECT MANAGEMENT

T I P 405

**Unit – I : Project Management Concepts :** Introduction, project characteristics, taxonomy of projects, project identification and formulation. Establishing the project and goals. Nature & context of project management; phases of PM, A Framework. For PM issues, PM as a conversion process, project environment & complexity. Organizing human resources, organizing systems & procedures for implementation. Projcet direction.

**Unit – II : Project Organization & Project Contracts:** Introduction, functional organization, project organization, matrix organization, modified matrix organization, pure project organization, selection of project organization structure, project breakdown structures, project contracts, types of contracts, types of payments of contractors.

**Unit – III : Project Appraisal & Cost Estimation:** Introduction, technical appraisal, commercial appraisal, economic appraisal, financial appraisal, management appraisal, social cost benefit analysis, project risk analysis, Cost analysis of the project, components of capital cost of a project, modern approach to project performance analysis.

**Unit – IV : Project Planning & Scheduling:** Introduction of PERT & CPM, planning and scheduling networks, time estimation, determination of critical path, CPM model, event slacks & floats, PERT model expected time for activities, expected length of critical path, calculating

the project length and variance, PERT & CMP cost accounting systems, lowest cost schedule, crashing of network.

**Unit –V : Project & Extensions of Network Models:**

Complexity of project scheduling with limited resources, resource leveling of project schedules, resource allocation in project scheduling- heuristic solution. Precedence networking- examples with algorithm, decision networks, probabilistic networks, computer aided project management- essential requirements of PM software, software packages for CPM. Enterprisewide PM , using spread sheets for financial projections

**References**

1. PROJECT MANAGEMENT BY KARZNER, CBS
2. ESSENTIAL OF PROJECT MANagements BY DENNIS LOCK, GROOVER

**ELECTRICAL MACHINES LABORATORY**

**PEE – 451  
L T P 002**

**Note: Minimum seven experiments are to be performed from the following list.**

1. To obtain magnetization characteristics of a dc shunt generator
2. To obtain load characteristics of a dc shunt generator
3. To obtain load characteristics of a dc series generator
4. To obtain load characteristics of a dc compound generator (a) cumulatively compounded (b) differentially compounded
5. To obtain speed – torque characteristics of a dc shunt motor
6. To obtain efficiency & voltage regulation of a single phase transformer by Sumpner's (back to back) test
7. To perform no load test & block rotor test on a three phase induction motor and determine parameters of equivalent circuit and efficiency
8. To perform no load test and blocked rotor test on a single phase induction motor and determine efficiency
9. To study operation of a 2-phase ac servomotor and a stepper motor

**MEASUREMENT & METROLOGY LAB**

**PIP- 452**

**Experiments:** Say minimum 7 out of following

1. Study & working of simple measuring instruments. Like vernier calipers, micrometer.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sinebar & slip gauges.
4. Study of limit gauges.
5. Study & angular measurement using level protector
6. Adjustment of spark plug gap using feeler gauges.
7. Study of dial indicator & its constructional detail
1. 8 Study and understanding of limits, fits & tolerances
8. Pressure measuring experiment
9. Temperature measurement experiment
10. Strain gauge measurement

**PRODUCTION ENGINEERING LAB**

**PIP-455**

(Min.7 experiments out of the following)

1. Gas welding experiment
2. Arc welding experiment
3. Resistance welding experiment
4. soldering & Brazing experiment
5. Gear cutting on Milling machine.
6. machining a block on shaper machine.
7. Finishing of a surface on surface- grinding machine.
8. Drilling holes on drilling machine and study of twist-drill.
9. Study of different types of tools and its angles & materials.