BACHELOR OF TECHNOLOGY

(Mechanical & Automation Engineering)

SIXTH SEMESTER EXAMINATION

Code No.	Paper	L	T/P	Credits
THEORY PAPERS				
ETME 302	Management of Manufacturing System	4	0	4
ETME 304	Machine Design-II	4	0	4
ETME 306	Metrology	3	1	4
ETME 308	Fluid Systems	3	1	4
ETME 310	Metal Cutting & Tool Design	3	1	4
PRACTICAL/VIVA VOCE				
ETME 352	Machine Design-II Lab.	0	4	2
ETME 354	Metrology Lab.	0	2	1
ETME 356	Fluid Systems Lab.	0	2	1
ETME 358	Metal Cutting & Tool Design Lab	0	2	1
ETME 360	Prog. IV Lab. (Pro-E-I)	0	2	1
	TOTAL	**17**	**15**	**26**

NOTE: 4-6 weeks training will be held after sixth semester. However, Viva-Voce will be conducted in the seventh semester.

Paper Code:ETME - 302	**L**	**T**	**C**
Paper: Management Of Manufacturing Systems	**4**	**0**	**4**

INSTRUCTIONS TO PAPER SETTERS:	**MAXIMUM MARKS: 75**
1.	Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2.	Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I:

Introduction: Production functions

Plant Organization: Organization principles of organization, Organization structure-line and staff organization.

Plant Location, Layout: Process layout product layout and combination – methods of layout, economics of layout; group technology. **[No. of Hrs.: 11]**

UNIT II:

Production Planning & Control: Types of products, demand, demand forecasting, marketing strategies, scheduling and control of scheduling production control.

Method Study: Definition and concepts, method study procedures, symbols, advantages, Flow process charts, Motion study, micro motion, SIMO charts, Systems Concepts, Classification analysis techniques.

Work Measurement: Definition, objectives & techniques, Time study equipment, performance rating, allowances, standard time, work sampling, PMTS. **[No. of Hrs.: 11]**

UNIT III:

Industrial Maintenance: Types, organization for maintenance department, Breakdown and preventive maintenance.

Inventory control and replacement analysis: Introduction replacement policy and method adopted, EOQ. **[No. of Hrs.: 11]**

UNIT IV:

Management Concepts: Development of management principles, scientific management, human relation aspects.

Production Cost Concepts: Introduction, cost of production, cost center and unit, classification and analysis of cost, break Even Analysis. **[No. of Hrs.: 11]**

Text Books:

1. S.K. Sharma, "Industrial Engg. & Operation Management", S.K. Kataria & Sons.
2. Dr. Ravi Shankar, "Industrial Engg. & Management", Galgotia Publications
3. M. Mahajan, "Industrial Engg. & Production Management", Dhanpat Rai & Co.

Reference Book:

1. Joseph S. Martinich, "Production & Operation Management", John Wiley & Sons.

Paper Code: ETME 304 **L T C**

Paper: Machine Design-II **4 0 4**

INSTRUCTIONS TO PAPER SETTERS:	**MAXIMUM MARKS: 75**
1.	Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2.	Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT I:

Design of Elements:-

Mechanical Drives: Selection of transmission, helical, bevel and worm gears, belt and chain drives. **[No. of Hrs.: 11]**

UNIT II:

Friction Clutches & Brakes: Common friction materials, shoe, band, cone and disc brakes their characteristics and design, friction clutches. **[No. of Hrs.: 11]**

UNIT III:

Bearings and Lubrication: Types of sliding bearing, materials, type of lubrication, design of sliding bearing, selection and application of rolling bearing, seals. **[No. of Hrs.: 11]**

UNIT IV:

Hoisting Elements; Wire ropes, hooks, pulley

Engine parts: Piston, connecting rod crank shaft **[No. of Hrs.: 11]**

Text Books:

1. Maleeve Hartman and O.P. Grover, "Machine Design", CBS Publication & Publishers.
2. V.B Bhandari, "Machine Design", Tata McGraw Hill.
3. P.C. Sharma and D.K Aggarwal., "Machine Design", S.K. Kataria & Sons.

Reference Book:

1. Mahadevan, "Design Data Book", CBS Publication & Publishers

Paper Code:ETME - 306 **L T C**
Paper: Metrology **3 1 4**

INSTRUCTIONS TO PAPER SETTERS:	MAXIMUM MARKS: 75
1.	Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2.	Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT - I

Principles of measurement: Definition of Metrology, difference between precision and accuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, application of Least Square principles, errors in measurement of a quality which is function of other variables.

Length Standards: Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges – its use and care, methods of building different heights using different sets of slip gauges.

Limits, fits and tolerances: Various definitions, IS919-1963, different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919-1963. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor's Principle, wear allowance on gauges. Different methods of giving tolerances on gauges, Numericals. **[No. of Hrs.: 11]**

UNIT - II

Comparators: Mechanical Comparators: Johanson Mikrokator and Signma Mechanical Comparator. Mechanical - optical comparator. Principles of Electrical and electronic comparators. Pneumatic comparators – advantages, systems of Penumatic gauging:- Flow type and back pressure type, Principle of working of back pressure gauges, different type of sensitivities and overall magnification, Solex Penumatic gauges and differential comparators. Numericals based on pneumatic comparators.

Angular Measurement: Sine Bar – different types of sine bars, use of sine bars in conjuction with slip gauges, precautions and calibration of sine bars. Use of angle gauges, spirit level, errors in use of sine bars. Numericals. Principle and working of Micro-optic autocollimator. Circular Division: dividing head and circular tables, circular division by precision Polygons. Caliper Principle, Calibration of polygons. Numerical based on circular division.

[No. of Hrs.: 11]

UNIT - III

Straightness and flatness: Definition of Straightness and Flatness error. Numericals based on determination of straightness error of straight edge with the help of spirit level and auto collimator. Numericals based on determination of flatness error of a surface plate with the help of spirit level or auto collimator.

Screw Thread Measurement :Errors in threads, Measurement of elements of screw threads – major dia, minor dia, pitch, flank angle and effective diameter (Two and three wire methods). Effect of errors in pitch and flank angles and its mathematical derivation. Numericals.

Gear Measurement: Measurement of tooth thickness – Gear tooth vernier caliper, Constant chord method, base tangent method and derivation of mathematical formulae for each method. Test plug method for checking pitch diameter and tooth spacing. Measurement of Gear Pitch, Parkinson Gear Tester, Numericals. **[No. of Hrs.: 11]**

UNIT - IV

Machine Tool Alignment: Machine tool tests and alignment tests on lathe. Alignment tests on milling machine. Alignment tests on a radial drilling machine.

Interferometry: Principle of measurement, Interferometry applied to flatness testing, surface contour tests, optical flats, testing of parallelism of a surface with the help of optical flat. Quantitative estimate of error in parallelism, Flatness Interferometer NPL-Gauge length interferometer for checking the error in slip gauges. Numericals based on Interferometry.

Surface texture: Introduction, different types of irregularities, standard measures for assessment and measurement of surface finish. **[No. of Hrs.: 11]**

Text Books:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers, Delhi
2. I.C. Gupta, "Engineering Metrology", Dhanpat Rai Publications, Delhi

Reference Books:

1. F.W. Galyer & C.R. Shotbolt, "Metrology for Engineers", ELBS edition.

Paper Code:ETME: 308	**L**	**T**	**C**
Paper: Fluid Systems	**3**	**1**	**4**

INSTRUCTIONS TO PAPER SETTERS:	**MAXIMUM MARKS: 75**
1.	Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2.	Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT - I

Introduction: Euler's equations for turbomachines; impulse and reaction forces due to fluid systems on stationery and moving system of vanes; jet propulsion. **[No. of Hrs.: 10]**

UNIT - II

Water Turbines: Classification; Pelton, Francis, Propeller and Kaplan turbines; velocity triangles; efficiency, draft tubes, governing.

Performance of Fluid Machines: Similarity laws applied to roto-dynamic machines; specific speed, unit quantities, Characteristic curves; use of models; cavitation and attendant problems in turbo-machines; selection of turbines hydroelectric plants **[No. of Hrs.: 12]**

UNIT - III

Pumps: Centrifugual pumps, velocity triangles; efficiency, turbine pumps; axial and mixed flow pumps.

Hydraulic Power Transmission: Transmission of hydraulic power through pipe lines; water hammer; precautions against water hammer in turbine and pump installations; hydraulic ram.

[No. of Hrs.: 11]

UNIT - IV

Power Hydraulics: Positive pumps; gear, vane, screw, variable delivery pumps, valves; flow control, pressure control, direction control, solenoid operated valve, hydraulic circuits, (meter-in, meter-out, bleed-off), fluid coupling and torque converter.

Pneumatic Power: Basic principles, comparison of pneumatic and hydraulic Systems.

[No. of Hrs.: 11]

Text Books:

1. Dr. R.K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publications (P) Ltd., 2002.

Reference Books:

1. Dr. D.S. Kumar, "Fluid Mechanics & Fluid Power Engineering", S.K. Kataria & Sons,2001
2. D.R. Malhotra & N.K. Malhotra, "The Fluid Mech. & Hydraulics", Satya Prakashan, 2001
3. V.P. Gupta, Alam Singh, Manish Gupta, "Fluid Mechanics, Fluid Mechanics & Hydraulics", CBS Publishers; 1999.

Paper Code:ETME -310 **L T C**
Paper: Metal Cutting & Tool Design **3 1 4**

INSTRUCTIONS TO PAPER SETTERS:	MAXIMUM MARKS: 75
1.	Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2.	Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

UNIT - I

Introduction: Definition of feed, depth of cut and cutting speed. Concept of specific cutting energy in metal cutting and Numerical based on calculation of machining time on lathe, drilling machine, shaper, milling machine and grinding machines considering specific cutting energy of materials.

Theory of Metal Cutting: Orthogonal and oblique cutting, types of chips, Factors affecting the chip formation, Cutting forces in orthogonal cutting and their measurement, Merchant circle and derivation of relationships between the cutting forces, chip thickness ratio, shear angle, stress and strain in the chip, work done and power required in metal cutting, plowing forces and the 'size-effect', apparent mean shear strength of work material. **[No. of Hrs.: 11]**

UNIT - II

Ernst Merchant Theory:- its assumptions and modifications. Relationship between cutting velocity, shear velocity and chip flow velocity. Mechanism of friction at chip-tool interface. Numericals based on metal-cutting.

Heat generation in Metal cutting: Heat generation and temperature distribution in metal cutting. Calculation of temperature in primary and secondary deformation zones and their measuring methods. **[No. of Hrs.: 11]**

UNIT - III

Machinability: Machinability and its criteria, forms of tool-wear in metal cutting, tool-life and its criteria, effect of different cutting parameters on tool-life. Economics of machining and numericals. Cutting fluids, their physical action and applications.

Grinding: Specifications of grinding wheel, Mechanics of grinding, effect of grinding conditions and type of grinding on wheel behaviour, equivalent diameter of grinding wheel.

[No. of Hrs.: 11]

UNIT - IV

Cutting Tool Design: General considerations, single point tool geometry. Principles of different cutting tool materials and their important characteristics. Geometry of a drill. Basic principles of design of a single point and multiple point tools i.e broaches and twist drill.

Jigs & Fixtures: Important considerations in jigs and fixture design. Main principles of designing of jigs & fixtures, elements of Jigs and fixtures. Different devices and methods of locations. Different types of clamps used in jigs & fixtures. **[No. of Hrs.: 11]**

Text Books:

1. Dr. P.C. Pandey & C.K. Singh, "Production Engg. Sciences", Standard Publisher. Distributors.
2. Dr. B.J. Ranganath, "Metal Cutting & Tool Design" Vikas Publishing House Pvt. Ltd.

Reference Books:

1. Geoffrey Boothroyd, "Fundamentals of Metal Machining & Machine Tools", Tata McGraw Hill Kogakusha Ltd.
2. P.N. Rao, "Manufacturing Technology", Tata McGraw Hill Publication Ltd.

Practicals:

ETME- 352	**Machine Design – II** .	**P**	**C**
	(i) Automotive Transmission	4	2
	(ii) Brakes		
	(iii) Clutches		
	(iv) Connecting rod of I.C. Engine		
	(v) Mechanical Hoist		
	(vi) Hydraulic Riveter		
	(vii) Passenger Lift		
ETME -354	**Metrology Lab.**	**P**	**C**
	Based on Course Work ETME 306	2	1
ETME – 356	**Fluid Systems**	**P**	**C**
	Based on Course work ETME – 308	2	1
ETME – 358	**Metal Cutting & Tool Design**	**P**	**C**
	Based on Course work ETME – 310	2	1
ETME – 360	**Programming –IV (Pro-E - I)**	**P**	**C**
		2	1

Text Books:

Programming –IV (Pro-E I)

1. Prof. Sham Tickoo, **"**Pro/Engineer Wild fire for Engineers & Designers Release 2.0**"**, WILEY- dreamtech India Pvt. Ltd., 2005.