Category	Title	Code	Credits-4 C			Theory Paper
HS-3	Entrepreneurship and Management Concepts	AU/FT/IP/ME/ TX 501	L	T	P	Max.Marks-100
			3	1	-	Min.Marks-35
						Duration-3hrs.

Unit-I: System Concepts: Types, definition & characteristics; supra & subsystems, key component; boundary & interface complexity; feedback (pull) & feed forward (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Altar's nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

Unit-II: Management: Importance, definition and functions; schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps in decision making, structured and unstructured decision; dimensions of organizations, size/specialization, behavior formalization, authority centralization, departmentalization, span and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination by task force, business process reengineering and process of change management, HR planning placement and training, MIS; attitudes and personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two factor theory, expectation theory, learning process, team work and stress management.

Unit-III: Marketing: Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction (goods and services) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research.
Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

Unit-IV: Productivity and Operations: Productivity, standard of living and happiness, types of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility, predetermined motion and time method, product and process specification, TQM, cost of quality, introduction to lean manufacturing (JIT), QFD, TPM & six sigma quality.

Unit V: Entrepreneurship : Definition and concepts, characteristics, compression with manager, classification, theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and indigenization, creating a venture, opportunity analysis competitive and technical factors, sources of funds, entrepreneur development program.

References:
1- Daft R; The new era of management; Cengage.
2- Bhat Anil, Arya kumar; Management: Principles ,Processes and Practices; Oxford higher edu.
3- Davis & Olson; Management Information System; TMH.
4- Steven Alter; Information systems, Pearson, www.stevenalter.com
5- Kotler P; Marketing management;
6- Khan, Jain; Financial Management;
7- ILO; Work study; ILO.
8- Mohanty SK; Fundamental of Entrepreneurship; PHI.

<div align="center">Course Contents</div>

Category	Title	Code	Credits-4C			Theory Paper
Departmental	Operation	AU 502	L	T	P	Max.Marks-100
Core DC-8	Research and		3	1	0	Min.Marks-35
	Supply Chain					Duration-3hrs.

Unit 1 Linear system and distribution models: Mathematical formulation of linear systems by LP, solution of LP for two variables only, special cases of transportation and assignment and its solution, Vogel's forward looking penalty method, cell evaluation degeneracy, use of SW Lindo, Tora, Excell.

Unit 2 Supply chain (SCM): Definition, importance, expenditure and opportunities in SCM; integration of inbound, outbound logistics and manufacturing to SCM, flow of material money and information, difficulties in SCM due to local v/s system wide (global) optimization and uncertainties in demand and transportation; Bull-whip effect; customer value; IT, info-sharing and strategic partnerships; plant and warehouse-network configuration; supply contracts and revenue sharing; outsourcing; transportation, cross docking and distribution, forecasting models in SCM; coordination and leadership issues; change of purchasing role and vendor rating, variability from multiple suppliers.

Unit 3 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, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP to ERP to SCM and e-business.

Unit 4(a) **Waiting Line Models** Introduction, Input process, service mechanism, Queue discipline, single server (M/M/1) average length and times by Little's formula, optimum service rate; basic multiple server models (M/M/s)
(b) **Competitive strategy**: concept and terminology, assumptions, pure and mixed strategies, zero sum games, saddle point, dominance, graphical, algebraic and LP methods for solving game theory problems.

Unit 5: (a) **Decision analysis**: decision under certainty, risk probability and uncertainty; Hurwicz criteria; AHP- assigning weight and consistency test of AHP
(b**) Meta-heuristics** Definition of heuristic and meta-heuristic algorithms; introduction to Tabu search, Simulated Annealing and Genetic algorithms and solution of traveling salesman and non linear optimization problems.

References:
1. Hillier FS and Liberman GJ; Introduction to Operations Research concept and cases; TMH
2. Simchi-Levi, Keminsky; Designing and managing the supply chain; TMH.
3. Srinivasan G; Quantitative Models In Operations and SCM; PHI Learning
4. Mohanty RP and Deshmukh SG; Supply Chain Management; Wiley India
5. Taha H; Operations research; PHI
6. Sen RP; Operations Research-Algorithms and Applications; PHI Learning
7. Ravindran , Philips and Solberg; Operations research; Wiley India
8. Vollman, Berry et al; Manufacturing planning and control for SCM; TMH.
9. Bowersox DJ, Closs DJ, Cooper MB; Supply Chain Logisti Mgt; TMH
10. Burt DN, Dobler DW, StarlingSL; World Class SCM; TMH
11. Bronson R ;Theory and problems of OR; Schaum Series; TMH

Category	Title	Code	Credits-6C			Theory Paper
Departmental Core DC -09	Metrology Measurement & control	AU/IP 503	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35 Duration-3hrs.

Unit 1 General concepts of measurement: definition-standards of measurement, errors in measurement, limit-gauging, various systems of limits, fits and tolerance, interchangeability, ISI and ISO system. basic principles and design of standards of measuring gauges, types of gauges and their design, accuracy and precision, calibration of instruments, principles of light interference, interferometer, measurement and calibration.

Unit 2 Linear and angular measurements: Slip gauges, micrometers, verniers, dial gauges, surface plates, comparators- mechanical, electrical, pneumatic and optical comparator, angular measuring instruments- sine bar, angle gauges, spirit level, autocollimators, clinometers; measurement of straightness, flatness and squareness.

Unit 3 Measurement of surface finish and measuring machines: surface finish- definitions, types of surface texture, surface roughness measurement methods, comparison, profile-meters, pneumatic and replica, measurement of run out and concentricity, length bar measuring machine, optical projection, comparator, tool makers microscope.

Unit 4 Metrology of screw threads and gears: internal/external screw thread, terminology, measurement of various elements of threads, thread micrometer method, two wire and three wire methods; gear- terminology, measurement of various elements, constant chord method, base tangent method, plug method; gear tester, gear tooth measurement; rolling gear tester.

Unit 5 Computer aided and laser metrology: Co-ordinate measuring machine; applications; laser micrometer, laser interferometer, laser scanning gauge, non contact and in- process inspection, vision system.

References:
1. ASTE; Handbook of industrial metrology; Prentice hall of india ltd
2. Jain R.K.; Engineering metrology; Khanna publishers
3. Gupta. I.C. "A text book of engineering metrology", Dhanpat rai and sons;
4. Galye G.N et al; Metrology for engineers; elbs,
5. Rajput R.K; Engineering metrology and instrumentation; Kataria &sons publishers

List of Experiments (Pl. expand it):
1. Study and use of verniers, micrometer and dial gauges
2. Study and use of limit gauges
3. Study and use of slip gauges and sine bar
4. Study of Tool Makers Microscope
5. Measurement of straightness, flatness and squareness
6. Measurement of surface finish
7. Measurement of screw threads by one wire and two wire
8. Measurement of parameters of gear teeth
9. Study and use of profile projector
10. Study and use of comparators
11. Study and use of Coordinate measurement machines.

Course Contents

Category	Title	Code	Credits-6C			Theory Paper
Departmental Core DC-10	Machine Component Design	AU/ME 504	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35
						Duration-3hrs.

Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority)

Unit 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.

Unit II: Shafts: Design of shaft under combined bending, twisting and axial loading; shock and fatigue factors, design for rigidity; Design of shaft subjected to dynamic load; Design of keys and shaft couplings.

Unit III: Springs: Design of helical compression and tension springs, consideration of dimensional and functional constraints, leaf springs and torsion springs; fatigue loading of springs, surge in spring; special springs, **Power Screws** design of power screw and power nut, differential and compound screw, design of simple screw jack.

Unit IV: Brakes & Clutches: Materials for friction surface, uniform pressure and uniform wear theories, Design of friction clutches: Disk , plate clutches, cone & centrifugal clutches.
Design of brakes: Rope, band & block brake, Internal expending brakes, Disk brakes.

Unit V Journal Bearing: Types of lubrication, viscosity, hydrodynamic theory, design factors, temperature and viscosity considerations, Reynold'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.

References:
1. Shingley J.E; Machine Design; TMH
2. Bhandari VB; Design Of Machine Elements; TMH
3. Sharma and Purohit; Design of Machine elements; PHI
4. Wentzell Timothy H; Machine Design; Cengage learning
5. Mubeen; Machine Design; Khanna Publisher
6. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
7. Sharma & Agrawal; Machine Design; Kataria & sons
8. Maleev; Machnine Design;

List of Experiment (Pl. expand it):
Designing and sketching of components contained in the syllabus

Category	Title	Code	Credits 6C			Theory Paper
Departmental Core DC-11	Automotive Transmission	AU-505	L	T	P	Max Marks – 100
			3	1	2	Min Marks – 35 Duration – 3 hrs

UNIT 1 Transmission requirements: requirements of transmission system, general arrangement of power transmission, general arrangement of rear-engine vehicle with live axles, general arrangement of dead- axle and axles transmission; four-wheel-drive transmission.

Unit 2 Clutches Requirements of clutches, principle of friction clutches, types of clutches and materials used- cone, single-plate, diaphragm-spring, multi-plate, centrifugal, over-running and ferlec-electromagnetic clutch.

Unit 3 Gear box: Need of gear boxes, types- sliding mesh, constant mesh and epicyclic, gear boxes; synchronizers: principle, early and later Warner synchronizer, Vauxhall synchronizer- gear materials-lubrication and design of gear box; Hydrodynamic drive: Advantages and limitations, principle of fluid coupling, constructional details, torque-capacity performance characteristics, drag torque, methods of minimizing drag torque; Torque converter: performance characteristics; single, multistage and poly-phase torque converters, converter-coupling-performance characteristics, coupling-blade angle and fluid flow, converter fluid.

Unit-4 Transmission systems-Drive line: Definition, forces & torques acting; types of drives-Hotchkiss, torque tube & radius rod drives; components- propeller shaft, slip joint, universal joints & constant velocity universal joints; front wheel drive; Final drive: definition; types- worm-wheel, straight-bevel gear, spiral-bevel gear & hypoid-gear drives; double-reduction & twin-speed final drives; Differential: Function, principle, construction and working; non-slip differential; differential lock; rear axle- loads acting & types; multi-axled vehicles.

Unit 5 Automatic transmission: Chevrolet "turbo glide" transmission, power glide transmission, hydraulic control system of automatic transmission; Electric drive: advantages and limitations, principle of early and modified Ward-Leonard system, modern electric drive for buses; performance characteristics.

References:
1 Heldt P.M.; Torque converters; Chilton Book Co.
2 Giri NK; Automobile Engineering; Khanna Publisher
3 .Newton, Steeds & Garret; Motor Vehicles; B.H. Publication.
4. Judge, A.W., Modern Transmission Systems, Chapman & Hall Ltd.
5. Check Chart; Automatic Transmission; Harper & Row Publication.

List of Experiments (Pl. expand it):
1. Study of transmission of front and rear engine vehicles
2. Study of front and rear-wheel-drive vehicle
3. Study of four wheel-drive vehicles
4. Study of various gear boxes and presynchronization systems
5. Study of fluid couplings, hydrodynamic drives and torque converters
6. Automatic transmission system study
7. Electric drive vehicle study