w.e.f. 2010-2011 academic year

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA-533003, Andhra Pradesh (India)

MECHANICAL ENGINEERING

COURSE STRUCTURE

I YEAR **I SEMISTER**

S. No.	Subject	T	P	Credits
1	English – I	3	-	2
2	Mathematics - I	3	-	2
3	Engineering Physics – I	3	-	2
4	Engineering Chemistry I	3	-	2
5	C Programming	3	-	2
6	Environmental Studies	3	-	2
7	Engineering Physics & Engineering Chemistry Laboratory -I	-	3	2
8	Engineering Workshop (Carpentry, Fitting, House wiring,)	-	3	2
9	C Programming Lab	-	3	2
10	English Proficiency Lab	-	3	2
	Total			**20**

I YEAR **II SEMISTER**

S. No.	Subject	T	P	Credits
1	English – II	3	-	2
2	Mathematics – II	3	-	2
3	Engineering Physics – II	3	-	2
4	Engineering Chemistry-- II	3	-	2
5	Engineering Drawing	3	-	2
6	Mathematical Methods	3	-	2
7	Engineering Physics & Engineering Chemistry Laboratory -II	-	3	2
8	English - Communication Skills Lab	-	3	2
9	IT Workshop	-	3	2
	Total			**18**

w.e.f. 2010-2011 academic year

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA-533003, Andhra Pradesh (India)

MECHANICAL ENGINEERING

COURSE STRUCTURE

II YEAR **I SEMISTER**

S. No.	Subject	T	P	Credits
1	Engineering Mechanics	4	-	4
2	Fluid Mechanics & Hydraulic Machinery	4	-	4
3	Thermodynamics	4	-	4
4	Managerial Economics & Financial Analysis	4	-	4
5	Electrical & Electronics Engineering	4	-	4
6	Computer aided Engineering Drawing Practice	6	-	4
7	Electrical & Electronics Engg. Lab	-	3	2
8	Fluid Mechanics & Hydraulic Machinery Lab	-	3	2
9	English Communication Practice	-	2	1
10	Professional Ethics &Morals - I	2	-	-
	Total			**29**

II YEAR **II SEMISTER**

S. No.	Subject	T	P	Credits
1	Kinematics of Machinery	4	-	4
2	Thermal Engineering -I	4	-	4
3	Production Technology	4	-	4
4	Mechanics of Solids	4	-	4
5	Metallurgy & Materials Science	4	-	4
6	Machine Drawing	6	-	4
7	Mechanics of Solids & Metallurgy lab	-	3	2
8	Production Technology Lab	-	3	2
9	English Communication Practice	-	2	1
10	Professional Ethics &Morals - II	2	2	-
	Total			**29**

w.e.f. 2010-2011 academic year

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA-533003, Andhra Pradesh (India)

MECHANICAL ENGINEERING

COURSE STRUCTURE

III YEAR **I SEMISTER**

S. No.	Subject	T	P	Credits
1	Dynamics of Machinery	4	-	4
2	Metal Cutting & Machine Tools	4	-	4
3	Design of Machine Members–I	4	-	4
4	Finite Element Methods	4	-	4
5	Thermal Engineering -II	4	-	4
6	Operations Research	4	-	4
7	Thermal Engineering Lab	-	3	2
8	Machine Tools Lab	-	3	2
9	IPR & Patent - I	2	-	-
	Total			**28**

III YEAR **II SEMISTER**

S. No.	Subject	T	P	Credits
1	Metrology	4	-	4
2	Instrumentation & Control Systems	4	-	4
3	Design of Machine Members– II	4	-	4
4	Robotics	4	-	4
5	Heat Transfer	4	-	4
6	Industrial Engg. & Management	4	-	4
7	Metrology & Instrumentation Lab	-	3	2
8	Heat Transfer Lab	-	3	2
9	IPR & Patent - II	2	-	
	Total			**28**

w.e.f. 2010-2011 academic year

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA-533003, Andhra Pradesh (India)

MECHANICAL ENGINEERING

COURSE STRUCTURE

IV YEAR **I SEMISTER**

S. No.	Subject	T	P	Credits
1	Refrigeration & Air Conditioning	4	-	4
2	CAD/CAM	4	-	4
3	Alternative Sources of Energy	4	-	4
4	Unconventional Machining Processes	4	-	4
5	**Open Elective**	4	-	4
6	**Departmental Elective – I**	4	-	4
7	Simulation Lab	-	3	2
8	Advanced Communication skills Lab	-	3	2
	Total			**28**

IV YEAR **II SEMISTER**

S. No.	Subject	T	P	Credits
1	Interactive Computer Graphics	4	-	4
2	**Departmental Elective – II**	4	-	4
3	**Departmental Elective – III**	4	-	4
4	**Departmental Elective – IV**	4	-	4
5	Project Work			12
	Total			**28**

Total credits obtained: 38+58+56+56= 208 Credits
Out of 208 Credits a student who obtains a Minimum of 200 Credits (With the credits of all Laboratories and Project) is Eligible to get Degree

DEPARTMENTAL ELECTIVE- I 1. Automobile Engineering 2. Computational Fluid Dynamics 3. Condition Monitoring 4. Rapid Prototyping	**DEPARTMENTAL ELECTIVE- II** 1. Metal Corrosion 2. Nanotechnology 3. Automation in Manufacturing 4. Industrial Hydraulics & Pneumatics
DEPARTMENTAL ELECTIVE- III 1. Non Destructive Evaluation 2. DBMS 3. Advanced Materials 4. Power Plant Engineering	**DEPARTMENTAL ELECTIVE- IV** 1. Production Planning and Control 2. Advanced Optimization Techniques 3. Gas Dynamics & Jet Propulsion 4. Quality and Reliability Engineering
OPEN ELECTIVE 1. MEMS 2. Industrial Robotics(Except for Mechanical Students)	

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

DYNAMICS OF MACHINERY

UNIT – I
PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms, (Demonstration of models in video show).

UNIT – II
FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication.

UNIT –III
CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission,

UNIT – IV
TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT-V
GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.

UNIT – VI
BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods.

UNIT –VII
BALANCING OF RECIPROCATING MASSES: Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – VIII

VIBRATIONS: Free Vibration of spring mass system – oscillation of pendulums, centers of oscillation and suspension. transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems, Simple problems on forced damped vibration, vibration isolation and transmissibility.

TEXT BOOKS:

1. Theory of Machines / S.S Ratan/ Mc. Graw Hill Publ.
2. Mechanism and machine theory by Ashok G. Ambedkar, PHI Publications.

REFERENCES:

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shiegly / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of machines / Khurmi/S.Chand.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

METAL CUTTING & MACHINE TOOLS

UNIT – I

Elementary treatment of metal cutting theory – element of cutting process – geometry of single point tool angles, chip formation and types of chips – built up edge and its effects chip breakers, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, tool materials, constructional features of speed gear box and feed gear box.

UNIT – II

Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout.

Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design.

UNIT – III

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

UNIT – IV

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT – V

MILLING MACHINE: Principles of working – specifications – classification of Milling Machines – principal features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

UNIT –VI

GRINDING: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

UNIT - VII

JIGS & FIXTURES: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

UNIT – VIII

CNC MACHINE TOOLS: CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines.

TEXT BOOKS:

1. Production Technology by R.K. Jain and S.C. Gupta.
2. Workshop Technology – B.S.Raghu Vamshi – Vol II

REFERENCES:

1. Metal cutting Principles by M.C. Shaw
2. Metal cutting and machine tools by Boothroyd
3. Production Technology by H.M.T. (Hindustan Machine Tools).
4. Production Engineering, K.C Jain & A.K Chitaley, PHI Publishers
5. Manufacturing technology II, P.N Rao,

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

DESIGN OF MACHINE MEMBERS - I

UNIT – I

INTRODUCTION: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design, tolerances and fits –BIS codes of steels.

STRESSES IN MACHINE MEMBERS: Simple stresses – combined stresses – torsional and bending stresses – impact stresses – stress strain relation – various theories of failure – factor of safety – design for strength and rigidity – preferred numbers. the concept of stiffness in tension, bending, torsion and combined situations – static strength design based on fracture toughness.

UNIT – II

STRENGTH OF MACHINE ELEMENTS: Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor notch sensitivity – design for fluctuating stresses – endurance limit – estimation of endurance strength – goodman's line – soderberg's line – modified goodman's line.

UNIT – III

Riveted and welded joints – design of joints with initial stresses – eccentric loading

UNIT – IV

Bolted joints – design of bolts with pre-stresses – design of joints under eccentric loading – locking devices – both of uniform strength, different seals.

UNIT – V

KEYS, COTTERS AND KNUCKLE JOINTS: Design of keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints- knuckle joints.

UNIT – VI

SHAFTS: Design of solid and hollow shafts for strength and rigidity – design of shafts for combined bending and axial loads – shaft sizes – BIS code. Use of internal and external circlips, gaskets and seals (stationary & rotary).

UNIT – VII

SHAFT COUPLING: Rigid couplings – muff, split muff and flange couplings, flexible couplings – flange coupling (modified).

UNIT – VIII

MECHANICAL SPRINGS:

Stresses and deflections of helical springs – extension -compression springs – springs for fatigue loading, energy storage capacity – helical torsion springs – co-axial springs, leaf springs.

TEXT BOOKS:

1. Machine Design, V.Bandari, TMH Publishers
2. Machine design – Pandya & Shah
3. Machine Design PSG Data hand book

REFERENCES:

1. Design of Machine Elements / V.M. Faires
2. Machine design / Schaum Series.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

FINITE ELEMENT METHODS

UNIT-I
Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

UNIT – II
Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III
Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations.

UNIT – IV
Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – V
Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT-VI
Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT – VII
Steady state heat transfer analysis : one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion.

UNIT-VIII
Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu
   / Prentice – Hall.
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.

REFERENCES:

1. An introduction to Finite Element Method / JN Reddy / McGrawHill
2. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
   Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson
   Education

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

THERMAL ENGINEERING – II

(Use of steam tables and Mollier chart is allowed)

UNIT – I

BASIC CONCEPTS: Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating. combustion: fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, flue gas analysis.

UNIT II

BOILERS : Classification – working principles – with sketches including H.P.Boilers – mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught- induced and forced.

UNIT – III

STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

UNIT – IV

STEAM TURBINES: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency

UNIT V

REACTION TURBINE: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency – calculation of blade height.

UNIT VI

STEAM CONDENSERS: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

UNIT – VII

GAS TURBINES: Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –closed and semi-closed cycles – merits and demerits, types of combustion chambers.

UNIT – VIII

JET PROPULSION : Principle of operation –classification of jet propulsive engines – working principles with schematic diagrams and representation on t-s diagram - thrust, thrust power and propulsive efficiency – turbo jet engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance evaluation, thrust augmentation – methods.

Rockets : Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines.

TEXT BOOKS:

1. Thermodynamics and Heat Engines- R.Yadav- Central book depot.
2. Gas Turbines – V.Ganesan /TMH
3. Heat Engineering – V.P Vasandani and D.S Kumar- Metropolitan Book Company, New Delhi

REFERENCES:

1. Gas Turbines and Propulsive Systems – P.Khajuria & S.P.Dubey - /Dhanpatrai
2. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman
3. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
4. Thermal Engineering-P.L.Bellaney/ Khanna publishers.
5. Thermal Engineering-M.L.Marthur & Mehta/Jain bros.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

OPERATIONS RESEARCH

UNIT – I

Development – definition– characteristics and phases – types of models – operation research models – applications.

ALLOCATION: Linear programming problem formulation – graphical solution – simplex method- artificial variables techniques -two–phase method, big-m method – duality principle.

UNIT – II

TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.

SEQUENCING – Introduction – flow **–**shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT – III

REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – IV

THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

UNIT – V

WAITING LINES: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

UNIT – VI

INVENTORY : Introduction – single item – deterministic models – purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT – VII

DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

UNIT – VIII

SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

TEXT BOOKS:

1. Operations Research / S.D.Sharma-Kedarnath
2. Introduction to O.R/Hiller & Libermann (TMH).

REFERENCES:

1. Operations Research /A.M.Natarajan,P.Balasubramani, A. Tamilarasi/Pearson Education.
2. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman
3. Operations Research / R.Pannerselvam,PHI Publications.
4. Operations Research / Wagner/ PHI Publications.
5. Operation Research /J.K.Sharma/MacMilan.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

THERMAL ENGINEERING LAB

1. I.C. Engines valve / port timing diagrams
2. I.C. Engines performance test (4 -stroke diesel engines)
3. I.C. Engines performance test on 2-stroke petrol
4. Evaluation of engine friction by conducting morse test on 4-stroke multi cylinder petrol engine
5. Determination of FHP by retardation and motoring test on IC engine
6. I.C. Engines heat balance.
7. Economical speed test of an IC engine
8. Performance test on variable compression ratio engines.
9. Performance test on reciprocating air compressor unit
10. Study of boilers
11. Dis-assembly / assembly of engines.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

MACHINE TOOLS LAB

1. Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on lathe machine.
4. Drilling and tapping
5. Shaping and planning
6. Slotting
7. Milling
8. Cylindrical surface grinding
9. Grinding of tool angles.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

III Year B.Tech. Mech. Engg. I-Sem.

IPR & PATENT-I

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