SYLLABUS

FOR

B.TECH. PROGRAMME

IN

MECHANICAL ENGINEERING

INSTITUTE OF TECHNOLOGY
ZAKURA CAMPUS
UNIVERSITY OF KASHMIR
SRINAGAR J&K, 190006
# COURSE STRUCTURE FOR B.Tech 8th Semester Mechanical

## AT UNIVERSITY OF KASHMIR

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Periods per week</th>
<th>Credits</th>
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<tr>
<td>MEE- 8117</td>
<td>Production &amp; Operations Management</td>
<td>3</td>
<td>1</td>
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<tr>
<td>MEE- 8217</td>
<td>Internal Combustion Engines</td>
<td>3</td>
<td>1</td>
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<tr>
<td>MEE- 8317</td>
<td>Departmental Elective- I</td>
<td>2</td>
<td>1</td>
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<tr>
<td>MEE-8417</td>
<td>Departmental Elective - II</td>
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<td>1</td>
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<tr>
<td>MEE- 8517</td>
<td>Final Year Project</td>
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<td>6</td>
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<tr>
<td>MEE- 8217L</td>
<td>I.C. Engine Lab.</td>
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<td><strong>Total</strong></td>
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## ELECTIVE - I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MEE 80*</td>
<td>Value Engineering</td>
</tr>
<tr>
<td>MEE 80*</td>
<td>Theory of Elasticity (TOE)</td>
</tr>
<tr>
<td>MEE80*</td>
<td>Introduction to Acoustics</td>
</tr>
<tr>
<td>MEE80*</td>
<td>HVAC</td>
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<tr>
<td>MEE 80*</td>
<td>Fracture Mechanics</td>
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## ELECTIVE - II

<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>MEE 80#</td>
<td>Power Plant Engineering (PPE)</td>
</tr>
<tr>
<td>MEE 80#</td>
<td>CAD of Thermal systems</td>
</tr>
<tr>
<td>MEE80#</td>
<td>Introduction to MEMS</td>
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Total Credits: 25
MEE-8117
Production and Operations Management

UNIT I
Managing and planning operations: Introduction to operations management (OM), historical perspective and growth, operations strategies for competitive advantage, forecasting (FC), nature and use of FC, sources of data, demand pattern, FC models, designing products, services and processes, new product design, product development, product life cycle, product development process, product reliability, process technology life cycle, flexible manufacturing systems.

UNIT II
Scheduling systems and aggregate planning for products and services: operations planning and scheduling systems, the aggregate planning process, strategies for developing aggregate planning, master schedule and rough cut capacity planning, implementing aggregate plans and master schedules, material requirement planning (MRP).

UNIT III

Text Book:

Reference Books:
MEE-8217
Internal Combustion Engines

UNIT I
Thermodynamics of actual working fluids: working fluid before combustion, valve and port timing diagrams, thermodynamic properties of fuel-air mixture before combustion, use of combustion charts for unburned mixture, use of combustion charts for burned mixture appropriate treatment of fuel air mixtures, fuel air cycles: definition, constants, volume fuel air cycle, limited pressure cycle, characteristics of fuel-air cycles, comparison of real and fuel cycles, air capacity of four stroke engines: ideal air capacity, volumetric efficiency, ideal induction process, actual induction process, effect of operating conditions on volumetric efficiency, effect of design on volumetric efficiency, estimating air capacity.

UNIT II

UNIT III
Heat losses and cooling: Area of heat flow engines, temperature profile, engine cooling system, numericals on heat transfer in IC engines, Engine design: selection of type, engine speed and principles of similitude, numerical on alternative fuels, numerical on diesel fuel injection system, numericals on engine specification and verification, numerical on two stroke engines, general design of petrol and diesel engine, numericals on engine design, determination of main dimensions, comparative numerical on two stroke engines and four stroke engines.
Text Book:

Reference Books:
MEE-8317

Theory of Elasticity

UNIT I

Introduction: Elasticity, stress components of stress and strain, Hook's law, equations in polar coordinates, plane stress and plane strain, strain at a point, Mohr circle for strain rosette, differential equation of equilibrium, boundary conditions, compatibility equations, overview of Airy's stress functions.

UNIT II

Two dimensional problems in rectangular coordinates: solution by polynomials, St.Venant's principles, determination of displacement, bending of beams, solution by Fourier series, Two dimensional problems in polar coordinates: equations in polar coordinates, equation about 1-axis, and pure bending in curved bars.

UNIT III

Determination of strains and displacement: Effect of circular hole on stress distribution in plate concentrated and vertical loading of a straight boundary, circular disc, general solution and its applications, analysis of stress and strain in three dimensions: stress at a point, principal stress, stress ellipsoid and stress director surface, homogenous deformation, strain at a point, principle strain rotation.

Text Books:

Reference Books:
MEE-8417

Power Plant Engineering

UNIT I

Introduction: Energy source for generation of electric power, principle types of power plants, their special features and applications, major power plants in India, steam power plants: Selection of site, general layout of the power plant, special features of the modern steam boilers, circulation principle, steam separation and purification, economizers and air pre-heater types and estimation of performance, super-heater and superheat control, feed water heaters, cooling tower, temperature and pressure control, introduction to hydro electric power plant: types of hydro-electric plant in combination with steam plant, runoff river plant in combination with steam plant, storage plant in combination with steam or nuclear plant, coordination of hydro-electric and gas turbine stations, coordination of different types of power plants.

UNIT II

Nuclear Power Plants: Nuclear fuel, nuclear energy by fission, main components of nuclear reactors, pressurized water, boiling water, liquid metal and gas nuclear reactors, diesel power plants: plant layout, two and four stroke cycle diesel engines, fuel injection, lubrication and cooling systems, supercharging and starting systems, gas and steam turbine combined cycles: simple gas and steam combined cycle power generation.

UNIT III

Economic Analysis of Power Plants and Tariffs: The cost of electrical energy, selection of types of generating equipment, performance and operating characteristics of power plant, load division among generators, tariff methods of electrical energy, combined operation of different power plants: Advantages of combined working, load division among power stations, storage.

Text Book:

Reference Books:
MEE-8517
Fracture Mechanics

UNIT I
Summary of basic problems and concepts in fracture: A crack in a structure, crack tip stresses, The Griffith criterion, crack opening displacement criterion, crack propagation, mechanisms of fracture and crack growth, cleavage fracture, ductile fracture, fatigue cracking, environmental assisted cracking, service failure analysis.

UNIT II
The elastic crack-tip stress field: Airy stress function, complex stress function, solution to crack problems, the effect of finite size, some special cases, elliptic cracks, the energy principles, the concept of energy release rate, the criterion for crack growth, the crack resistance, the concept of J-integral.

UNIT III
Crack-tip plastic zone: Irwin’s plastic zone correction, the Dug-dale approach, plane stress versus plane strain, plastic constraint factor, the thickness effect, application of Von Mises and Tresca yield criteria to obtain plasticity effected regions, dynamics and crack arrest, crack speed and kinetic energy, the dynamic stress intensity and elastic energy release rate, principles of crack arrest.

Text Book:

Reference Book:
MEE-8217L
I.C Engines Lab

Experiments to be conducted
1. Study of two stroke spark ignition engine model.
2. Study of four stroke spark ignition engine model.
3. Study of four stroke diesel engine model.
4. Study of rotary wankel engine.
5. Study of models of gas turbine engines.
6. Study of single cylinder four stroke direct injection diesel engine. (cut section)
7. Study of multi-cylinder optical spark ignition engine.
8. Experimental study of characteristic performance curves of spark ignition engine using gasoline as fuel.
10. Experimental study of characteristic performance curves of compression ignition engine using biodiesel blends, with diesel as fuel.
11. Study of engine components (cylinder block, crank shaft etc).
UNIT I:

Introduction to value engineering (VE) & value analysis (VA), Life Cycle of a product, Methodology of VE, Reasons for the existence of unnecessary costs. Quantitative definition of Value, use Value and Prestige value, Estimation of product Quality/Performance, Types of functions, Relationship between use functions and Esteem Functions in product design, Functional cost and functional worth, Effect of value improvement on profitability, Tests for poor value, Aims of VE: systematic approach.

UNIT II

Elementary introduction to VE, Job plan functional approach to value improvement, Various phases and techniques of the job plan, Factors governing project selection, Types of projects, Life cycle costing for managing the total value, concepts in LCC, Present value concept, Annuity concept, net present value, Pay Back period, internal rate of return on investment (IRR), Examples and Illustrations. Creative thinking and creative judgement, positive or constructive discontent, Tangible and intangible costs of implementation, False material, Labour and overhead saving, VE/VA yardsticks, Relationship between savings and probability of success, Reliability Estimation, system Reliability, Reliability elements in series and parallel.

UNIT III

PHASES AND TECHNIQUES OF VE JOB PLAN:
General Phase, Information phase, Function phase, Creativity/Speculation Phase, Evaluation Phase, Investigation Phase and Recommendation Phase: Value improvement recommendation theory, determination of cut-off point (cop), road blocks in implementation. Decision Matrix/Evaluation Matrix, Quantitative comparison of Alternatives, Estimation of weights factors and efficiencies, Utility transformation functions, Bench marking, Perturbation of weight factors (sensitivity analysis), and Examples.

FAST Diagramming: Critical path of functions, HOW, WHY & WHEN Logic, Supporting and all time functions.

Reference Books: