

**PANDIT DEENDAYAL PETROLEUM UNIVERSITY**  
**SCHOOL OF TECHNOLOGY**  
**COURSE STRUCTURE FOR B.TECH. MECHANICAL ENGINEERING**

SEMESTER V			B.TECH. MECHANICAL ENGINEERING										
Sr. No	Course Code	Course Name	Teaching Scheme					Exam Scheme					Total Marks
			L	T	P	C	Hrs/wk	Theory			Practical		
								MS	ES	IA	LW	LE/Viva	
1	ME 301T	Manufacturing Processes-II	3	0	-	6	3	30	60	10	--	--	100
	ME-301P		--	--	2	1	2	--	--	--	25	25	50
2	ME 302T	Production and Operation Management	3	0	0	6	3	30	60	10	--	--	100
3	ME 303T	Power Plant Engineering	3	0	--	6	3	30	60	10	--	--	100
	ME 303P		--	--	2	1	2	--	--	--	25	25	50
4	ME 304T	Dynamics of Machines	3	0	--	6	3	30	60	10	--	--	100
	ME-304P		--	--	2	1	2	--	--	--	25	25	50
5	ME 305T	Control Systems	3	0	--	6	3	30	60	10	--	--	100
	ME 305P		--	--	2	1	2	--	--	--	25	25	50
6	ME 306T	Heat and Mass Transfer	3	0	--	6	3	30	60	10	--	--	100
	ME 306P		--	--	2	1	2	--	--	--	25	25	50
7		Industrial Orientation	--	--	--	3	--	--	--	--	--	100	
		Total	<b>18</b>	<b>0</b>	<b>10</b>	<b>44</b>	<b>28</b>						950

MS = Mid Semester, ES = End Semester;

IA = Internal assessment (like quiz, assignments etc)

LW = Laboratory work; LE = Laboratory Exam

**ME 301T MANUFACTURING PROCESS - II**

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

**UNIT I**

**09**

**CASTING:** Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems  
Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, special casting processes Centrifugal; Die, Investment. Methods of Melting: Crucible melting and cupola operation, steel making processes, special.

**UNIT II**

**15**

**Welding:** Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.

**Cutting of Metals:** Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals. Inert Gas welding, TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser Welding, Soldering & Brazing. Heat affected zones in welding;

**Welding defects:** causes and remedies – destructive nondestructive testing of welds. Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts.

**UNIT III :**

**Classification of Metal Forming Processes**

**09**

**Rolling:** Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements.

**Stamping, forming and other cold working processes :** Blanking and piercing – Bending and forming Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning – Types of presses and press tools. Forces and power requirement in the above operations. Sheet metal operations.

**Extrusion of Metals:** Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion.

**UNIT IV**

**06**

**Forging processes:** Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging– Roll forging – Forging hammers, Rotary forging – forging defects. Coating techniques

**Processing of Plastics:** Types of Plastics, Properties, applications and their Processing methods & Equipment (blow & injection molding).

**Approximate Total : 39 Hrs**

**REFERENCES/BOOKS :**

1. Kalpakjin S, Manufacturing Engineering and Technology,
2. Lindberg, Process and materials of manufacturing, Pearson Edu.
3. Roenthal, Principles of Metal Castings.
4. Paramar , Welding Process
5. Sarma P C, Production Technology
6. Suresh Dalela & Ravi Shankar, Production Engineering, Galgotia Publications Pvt. Ltd.

ME 301P MANUFACTURING PROCESS - II										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50
<p><b>List of Experiments:</b></p> <ol style="list-style-type: none"> <li>1. Shielded metal arc welding,</li> <li>2. Gas metal arc welding,</li> <li>3. Gas tungsten arc welding,</li> <li>4. Gas welding, Gas cutting,</li> <li>5. Plasma cutting</li> <li>6. Resistance welding – spot, projection, butt welding,</li> <li>7. Soldering and Brazing.</li> <li>8. Injection molding of plastics</li> <li>9. Development of macro and microstructure of welded joints.</li> <li>10. Industrial visit to foundry/ forming industry/ plastic industry.</li> <li>11. Friction Welding</li> <li>12. Friction Stir Welding</li> </ol>										

ME 302T PRODUCTION AND OPERATIONS MANAGEMENT										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100
<b>UNIT I</b>					<b>10</b>					
Introduction to Operations Management, operations strategy. Forecasting, time series methods of forecasting, causal methods of forecasting, , measures of error, qualitative forecasting. Inventory management, inventory costs, the basic EOQ model, EOQ with gradual replenishment, price break models, reorder point, safety stock, the Newsboy problem.										
<b>UNIT II</b>					<b>10</b>					
Material Requirements Planning (MRP), components of MRP, MRP logic, lot sizing in MRP systems (LFL, EOQ, POQ, LTC, LUC, etc.), introduction to ERP systems. Operations scheduling, loading, sequencing methods (SPT, EDD, Moore's method, Johnson's method, etc.). Introduction to project management, Gantt charts, CPM, AOA/AON networks, concept of slack, the critical path, probabilistic time estimates, project crashing.										
<b>UNIT III</b>					<b>9</b>					
Waiting line models, various types of queues (M/M/1, M/D/1, M/G/1, M/M/S, etc.), measures of queue performance, management of waiting lines. Introduction to facility planning, the facility location problem, factors influencing facility location, facility location models, process layouts, layout methods, computerized algorithms for facility layout, product layouts, fixed position layouts, cellular layouts, layout of service facilities.										
<b>UNIT IV</b>					<b>9</b>					
Introduction to quality management, cost of quality, quality management systems, concepts of TQM, quality tools, process capability, concept of six sigma, quality tools, control charts ( $\bar{X}$ and R charts, p-chart, np-chart, c chart), acceptance sampling, AQL, LTPD, OC curves. Lean manufacturing, JIT, the Toyota Production System, waste elimination, push vs. pull systems, use of kanban.										
<b>Approximate Total 39 hrs.</b>										
<b>Texts and References</b>										
1. Chase, R. B., Ravi Shankar, Jacobs, F. R. and Aquilano, N. J., Operations and Supply Management, Tata McGraw Hill.										
2. Buffa, E. S. and Sarin, R., Modern Production and Operations Management, John Wiley.										
3. Russell, R. S. and Taylor, B. W., Operations Management along the Supply Chain, Wiley India.										
4. Heizer J., Render, B. and Rajashekhar, J., Operations Management, Pearson Education.										

ME 303T POWER PLANT ENGINEERING										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100
<b>UNIT I</b>					<b>10</b>					
<p><b>Introduction:</b> Power and energy, classification of sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, steam generators and steam prime movers, steam condensers, water turbines.</p> <p><b>Variable load problem:</b> Industrial production and power generation compared ideal and realized load curves, terms and factors. Effect of variable load on power plant operation, methods of meeting the variable load problem.</p> <p><b>Power plant economics and selection:</b> Effect of plant type on costs, rates, fixed elements, energy element, customer element and investor's profit; depreciation and replacement, theory of rates. Economics of plant section, other considerations in plant and site selection.</p>										
<b>UNIT II</b>					<b>10</b>					
<p><b>Diesel power plant :</b> General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, cooling system, diesel plant operation and efficiency, heat balance, trouble shooting and remedies.</p> <p><b>Hydro electric station:</b> Principles of working, applications, site selection classification and arrangement of hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems.</p>										
<b>UNIT III</b>					<b>15</b>					
<p><b>Steam power plant :</b> steam generator classification, critical and super critical boilers, fluidized bed boilers, boilers mountings and accessories, general layout of a steam power plant, different systems such as fluid handling system, combustion system, draft, ash handling system, feed water treatment, and condenser and cooling system, turbine auxiliary systems such as governing feed heating, turbine mountings, lubrication, flange heating and gland leakage, operation and maintenance of steam power plant, heat balance and efficiency, trouble shooting and remedies.</p> <p><b>Nuclear power plant:</b> Principles of nuclear energy, classification of reactors, basic components.</p>										
<b>UNIT IV</b>					<b>4</b>					
<p><b>Electrical system:</b> generators and generator cooling, transformers and their cooling, bus bar. etc.</p> <p><b>Instrumentation:</b> Purpose, classification, selection and application, recorders and their use, listing of various control rooms.</p> <p><b>Pollution:</b> Pollution due to power generation</p>										
										<b>Approximate Total : 39 Hrs</b>
<b>Texts and References</b>										
<ol style="list-style-type: none"> <li>1. F.T.Morse, Power Plant Engineering, Affiliated East-West Press Pvt. Ltd; New Delhi Madras.</li> <li>2. Verma Mahesh, Power Plant Engineering, Metropolitan Book Company Pvt. Ltd New Delhi</li> <li>3. Modern Power Station Practice, Central Electricity Generating Board(UK) Vol.I to 7</li> <li>4. "Power Plant Technology", El Wakil</li> <li>5. P.K. Nag, Power Plant Engineering, Tata McGraw Hill.</li> <li>6. R.Yadav, Steam &amp; Gas Turbines &amp; Power Plant Engineering, Central Publication House.</li> </ol>										

ME 303P POWER PLANT ENGINEERING										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50
<p><b>List of Experiments:</b></p> <ol style="list-style-type: none"> <li>1. Study of supply and demand load characteristic</li> <li>2. Performance characteristic of diesel power gen set</li> <li>3. Experiment on determination efficiency load curves and governing system of hydraulic power plant</li> <li>4. Determination of different systems, layout and requirement of steam power plant</li> <li>5. Performance characteristic of gas turbine power gen set</li> <li>6. Study of nuclear power plant systems</li> <li>7. Scenario generation for combined plant operation</li> <li>8. Case study on economics of power generation</li> <li>9. Operation, maintenance and testing of power plant instrumentations &amp; equipments</li> <li>10. Study on green engineering compliance of a power plant</li> <li>11. visits to thermal, hydraulic and nuclear power plant</li> </ol>										

**ME 304T Dynamics of Machines**

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

**UNIT I**

**9**

**Gears:** Laws of gearing, gears terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with a gear, interference and under cutting, bevel, helical and spiral gears.

**Gear Trains:** Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes-sliding and constant mesh gear box for automobiles.

**Gyroscope:** angular velocity, angular acceleration, gyroscopic torque, gyroscopic effect on naval ships, stability of an automobile, two-wheel vehicle, rigid disc at an angle fixed to a rotating shaft.

**UNIT II**

**10**

**Brakes And Dynamometers:** Simple block brakes, internal expanding brake, band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operations.

**Turning Moment Diagram And Fly Wheels:** Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design.

**Governors :** Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronism and hunting.

**UNIT III**

**9**

**Balancing:** Balancing of rotating masses Single and multiple – single and different planes.

**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.

**UNIT IV**

**11**

**VIBRATION:** Free Vibration of mass attached to vertical spring – 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 & Transmissibility

**APPROXIMATE TOTAL 39Hours**

**Texts and References**

1. S. S. Ratan, "Theory of Machines", Tata Mc Graw-Hill publications, New Delhi
2. Ghosh Amitabha, "Theory of Mechanisms and Machines", East West Press
3. Rao J.S. and Dukkanati R.V, "Mechanisms and Machines theory" , Wiley Eastern Ltd.
4. Shigley J.E and Uicker J.J, "Theory of Machines and Mechanisms," , Oxford University Press



ME 304P Dynamics of Machines										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

**List of Experiment:**

1. Study of Gyroscopic effect and determination of gyroscopic couple.
2. Determination of jump speed of cam-follower system.
3. Dynamic balancing of the rotating mass system.
4. To study various governors.
5. To study the free vibration and to determine the natural frequency of vibration of Tow-Rotor system.
6. To study the torsional vibration and to determine the natural frequency vibration of single rotor system.
7. Study of longitudinal vibration and to determine the frequency of vibration.
8. To study the damped torsional vibration and determine the damping coefficient.
9. Determination of whirling speed of shafts.
10. To study various gear trains.

ME 305T CONTROL SYSTEMS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100
<b>UNIT I</b>					<b>10</b>					
<p>Introduction to Control Systems: Meaning &amp; need of automation, types of automation, fixed, programmable and integration. Open loop and Closed Loop Systems, Principle, Working. State Equations, Procedure for writing state equations, Mathematical modeling of physical systems.</p> <p>Analog Control Systems: Transfer function, procedure for writing transfer function. Signal Flow diagram, Procedure.</p> <p>Stability Conditions: Routh Hurwitz criterion, Nyquist criterion, Bode plot, roots locus method.</p> <p>Advanced Electro Mechanical Systems: Robotics system, integration of various systems, vision speech, Collision avoidance, others control, CNC machines, controls of CNC machines applications.</p>										
<b>UNIT II</b>					<b>10</b>					
<p>Component of automation: Actuators details of solenoids, torque motors, hydraulic, pneumatic, valve and circuits; controllers digital, analog, open and closed loop control, servo system, analysis and response, control configuration; sensors characteristics, contact, non contact types, pressure switch, proximity and position sensors, encoders, resolver, synchros; vision systems components, image, camera, capturing systems, processing systems, bar coding and other identification systems.</p>										
<b>UNIT III</b>					<b>10</b>					
<p>Logic control and PLCs: logic control, elements, programmable logic controllers, applications, architecture, operation, programming of PLCs with applications.</p> <p>Automated material handling systems: automated flow lines, transfer mechanism, conveyors, robots, automated guided vehicles; categories, technologies and control. Automated storage and retrieval systems, categories and components.</p> <p>Automated inspection systems: in process gauging systems, coordinate measuring machines, construction, operational, modes and different systems. Automated assembly systems</p>										
<b>UNIT IV</b>					<b>9</b>					
<p>Factory communication: interface standards, communication networks, LAN, protocols, OSI and MAP.</p> <p>Flexible manufacturing systems: types, components, architecture and control. Computer integrated manufacturing.</p>										
<b>Approximate Total : 39 Hrs</b>										
<b>Texts and References</b>										
<ol style="list-style-type: none"> <li>Morriss S. B., Automated manufacturing systems, Glanncoe Megra International series</li> <li>Groover Mikell, Automated production systems and computer integrated manufacturing, PHI</li> <li>Boothroyd G and Poli C, Automated assembly, Marcel dekker, New York</li> <li>David Bed Worth et al., Computer Integrated design and manufacturing, Mc Graw Hill</li> <li>C. Kuo, Automatic Control System, Benjamin, , Prentice Hall, New Delhi</li> <li>John, D. Lenk, Complete Guide to Video Cassate Recorder: Operation and Servicing, , Prentice Hall of India.</li> <li>Phillipe Coiffet and Michael Chirouze An Introduction to Robot Technology, , McGraw Hill</li> <li>John, J. D. and Constantine, H. Houpis Linear Control Systems: Analysis and Design, Conventional &amp; Modern, 1985.</li> <li>Anthony C, Robot Technology: Theory, Design and Application , McDonald</li> <li>Ogatta K , Modern Control Engineering, PHI</li> <li>Nagartah I. J., Gopal M., Control system engineering, New Age International</li> </ol>										

ME 305P CONTROL SYSTEMS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50
<p><b>List of Experiments:</b></p> <ol style="list-style-type: none"> <li>1. Study on fixed, programmable, flexible and integrated automation system</li> <li>2. Design of open loop control system using actuator, sensor or vision system.</li> <li>3. Design of closed loop system using actuator, sensor or vision system and controller</li> <li>4. Development of logic control system</li> <li>5. Experiment on programmable PLCs</li> <li>6. Study of conveyor material handling system</li> <li>7. Study of conveyor material inspection system</li> <li>8. Experiment on loading, unloading and indexing of tool</li> <li>9. Experiment of coordinate measuring system using CNC Lathe/Milling machine</li> <li>10. Developing understanding of LAN communication system of PDPU campus</li> <li>11. Data acquisition system using lab view</li> <li>12. PLC programming using ladder diagrams</li> <li>13. Introduction to Simulink.</li> <li>14. Industrial visit of M/s Bosch, A'bad.</li> </ol>										

**ME 306T HEAT AND MASS TRANSFER**

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

**UNIT I**

**12**

**Introduction:** Various modes of heat transfer; Fourier's law of heat conduction; effect of temperature on thermal conductivity of various kinds of materials, gases and liquids; thermal diffusivity.

**Heat Conduction:** Derivation of generalized three dimensional equation of heat conduction in the Cartesian, cylindrical and spherical co-ordinates; One dimensional steady state conduction through plane and composite walls; hollow and composite cylinders; hollow and composite spheres; electrical analogy; overall heat transfer coefficient; and critical radius of insulation. 1-D heat conduction through metal rod with variable thermal conductivity and heat sources. Transient heat conduction – lumped heat system analysis; semi-infinite solids. Heat conduction through fins: Types of fin; heat transfer through rectangular fin; infinitely long fin; fin insulated at the tip and fin losing heat at the tip; efficiency and effectiveness of fin, Biot number.

**UNIT II**

**09**

**Heat Convection:** Newton – Rikhman law; dimensional analysis applied to forced and free convection; Dimensionless numbers & their physical significance; empirical correlations for free and forced convection. Hydrodynamics of boundary layer; laminar boundary layer equations on a flat plate and in a tube; laminar forced convection on a flat plate and in a tube; continuity, momentum and energy equations; thermal and hydrodynamic boundary layer; Blasius solution for laminar boundary layer; Von-Karman integral solution.

**UNIT III**

**09**

**Thermal Radiation:** Introduction, Concept of radiation, absorptivity, reflectivity & transmissivity, black, white and grey surfaces, emissive power & emissivity. Laws of radiation – Planck, Stefan – Boltzman , Wein's displacement, Kirchoff. Intensity of radiation & solid angle, Lambert's cosine law, shape factor. Radiation heat exchange between black bodies, geometric configuration factor, heat exchange between non-black bodies- infinite parallel planes and infinite long concentric cylinders, radiation shield, heat exchange between two grey surfaces, electrical analogy to simple problems and non-luminous gas radiation.

**UNIT IV**

**09.**

**Heat Exchangers:** Different types of heat exchangers, heat exchange performance analysis, LMTD for parallel & counter flow heat exchanger, overall heat transfer coefficient, fouling, correction factor for multi-pass arrangement, effectiveness and number of transfer unit for parallel and counter flow heat exchanger, design of industrial heat exchanger. **TEMA standards.**

**Introduction to Mass Transfer:** Mass and mole concentrations, molecular diffusion, eddy diffusion, Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar and turbulent convection, Combined heat and mass transfer, the wet and dry thermometer.

**Approximate Total : 39 Hrs**

## **Texts and References**

1. F. P. Incropera and D. P. DeWitt, Introduction to Heat Transfer, Wiley and Sons, New York
2. J. P. Holman, Heat Transfer, Tata McGraw Hill Book Company
3. F. White, Heat and Mass Transfer, McGraw Hill
4. P. S. Ghoshdastidar, Heat Transfer, Oxford University Press, New Delhi
5. S. P. Sukhatme, A Textbook of Heat Transfer, S. P., Universities Press, Hyderabad
6. C. P. Kothandaraman, Fundamentals of Heat and Mass Transfer, New Age International Publishers
7. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age International Publishers, New Delhi

**ME 306P HEAT AND MASS TRANSFER**

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

**List of Experiments:**

1. Thermal conductivity of metal rod
2. Thermal conductivity of liquid
3. Heat transfer in natural convection
4. Heat transfer if forced convection
5. Estimation of Stefan Boltzmann constant for thermal radiation
6. Heat transfer in parallel and counter flow heat exchangers
7. Emissivity measurement
8. critical radius of insulation material

<b>ME 312 Industrial Orientation</b>							
<b>Teaching Scheme</b>					<b>Examination Scheme</b>		
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Hrs/Week</b>	<b>Report Writing</b>	<b>V/V</b>	<b>Total</b>
--	--	--	<b>3</b>	--	<b>80</b>	<b>20</b>	<b>100</b>
Duration: Three weeks after IV semester							
Examination of Industrial Orientation will be conducted in V semester							