VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

3rd to 8th Semester BE- INDUSTRIAL AND PRODUCTION ENGINEERING
Scheme of Teaching and Examinations

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

III SEMESTER: INDUSTRIAL ANDPRODUCTION ENGINEERING

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Durations in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18IP32	Mechanics of Materials	IPE/MECH	3	2	--	03	40	60	100	4
3	PCC	18IP33	Basic Thermodynamics		2	2	--	03	40	60	100	3
4	PCC	18IP34	Mechanical Measurements		2	2	--	03	40	60	100	3
5	PCC	18IP35	Fluid Mechanics		2	2	--	03	40	60	100	3
6	PCC	18IP36	Manufacturing Process -1		2	2	--	03	40	60	100	3
7	PCC	18IPL37	Foundry and Forging Laboratory		--	2	2	03	40	60	100	2
8	PCC	18IPL38	Metrology and Measurements Laboratory		--	2	2	03	40	60	100	2
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPC39/49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60	100	
		Total			Examination is by objective type questions							
					13	**16**		**24**	**420**	**480**		
					OR	**OR**	**04**	**OR**	**OR**	**OR**	**900**	**24**
					14	**18**		**26**	**360**	**540**		

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.
(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE Activity Points to be earned by students admitted to BE/B.Tech/B.Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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IV SEMESTER: INDUSTRIAL ANDPRODUCTIONENGINEERING

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Durations in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT41	Complex Analysis, Probability and Statistical Methods	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18IP42	Computer Aided Machine Drawing	IPE/MECH	2	-	4	03	40	60	100	4
3	PCC	18IP43	Kinematics of Machines		2	2	--	03	40	60	100	3
4	PCC	18IP44	Manufacturing Process- II		2	2	--	03	40	60	100	3
5	PCC	18IP45	Material Science and Metallurgy		2	2	--	03	40	60	100	3
6	PCC	18IP46	CAD/CAM		2	2	--	03	40	60	100	3
7	PCC	18IPL47	Machine Shop		--	2	2	03	40	60	100	2
8	PCC	18IPL48	Metallography and Material Testing Laboratory		--	2	2	03	40	60	100	2
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPC39/49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60	100	
		Total			Examination is by objective type questions							
					12 OR 13	**14 OR 16**	**08**	**24 OR 26**	**420 OR 360**	**480 OR 540**	**900**	**24**

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

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Course prescribed to lateral entry Diploma holders admitted to IV semester of Engineering programs

10	NCMC	18MATDIP41	Additional Mathematics - II	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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V SEMESTER: INDUSTRIAL ANDPRODUCTION ENGINEERING

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Durations in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18IP51	Management and Entrepreneurship	IPE/MECH	2	2	--	03	40	60	100	3
2	PCC	18IP52	Design of Machines Elements		3	2	--	03	40	60	100	4
3	PCC	18IP53	Quality Assurance and Reliability		3	2	--	03	40	60	100	4
4	PCC	18IP54	Hydraulics and Pneumatics		2	2	--	03	40	60	100	3
5	PCC	18IP55	Work Study and Ergonomics		2	2	--	03	40	60	100	3
6	PCC	18IP56	Composite Materials		2	2	--	03	40	60	100	3
7	PCC	18IPL57	Mechanical and Fluid Power Lab		--	2	2	03	40	60	100	2
8	PCC	18IPL58	Work study and Ergonomics Lab		--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/ Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
				Total	**15**	**16**	**04**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VI SEMESTER: INDUSTRIAL ANDPRODUCTION ENGINEERING

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Durations in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18IP61	Computer Integrated Manufacturing	IPE/MECH	3	2	--	03	40	60	100	4
2	PCC	18IP62	Operations Research		3	2	--	03	40	60	100	4
3	PCC	18IP63	Tool Engineering and Design		3	2	--	03	40	60	100	4
4	PEC	18IP64X	Professional Elective -1		2	2	--	03	40	60	100	3
5	OEC	18XX65X	Open Elective -A		2	2	--	03	40	60	100	3
6	PCC	18IP66	CAD/CAM Lab	IPE/MECH		2	2	03	40	60	100	2
7	PCC	18IPL67	Machine Tool Lab		--	2	2	03	40	60	100	2
8	MP	18IPMP68	Mini-Project		--	--	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VIIand VIII semesters.								
				Total	**16**	**08**	**06**	**24**	**320**	**480**	**800**	**24**

Note: PCC: Professional Core, PEC: Professional Elective, OEC: Open Elective

Professional Elective -1

Course code under18IP64X	Course Title
18IP641	Theory of Metal Forming
18IP642	Engineering Economy
18IP643	Total Quality Management

Open Elective –A

18IP651	Value Engineering
18IP652	Advanced Machining Process
18IP653	Management Information Systems

Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the Programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the Programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Mini-project work:
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students.
CIE procedure for Mini-project:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the Mini-Project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-Project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
SEE for Mini-project:
(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.
Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/ complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VII SEMESTER: INDUSTRIAL ANDPRODUCTION ENGINEERING

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Durations in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18IP71	Operations Management	IPE/MECH	2	2	--	03	40	60	100	3
2	PCC	18IP72	Mechatronics		2	2	--	03	40	60	100	3
3	PEC	18IP73X	Professional Elective - 2		2	2	--	03	40	60	100	3
4	PEC	18IP74X	Professional Elective - 3		2	2	--	03	40	60	100	3
5	OEC	18XX75X	Open Elective -B		2	2	--	03	40	60	100	3
6	PCC	18IPL76	Software Applications Lab	IPE/MECH		2	2	03	40	60	100	2
7	PCC	18IPL77	CNC and Robotics Lab		--	2	2	03	40	60	100	2
8	Project	18IPP78	Project Work Phase – 1		--	--	2	--	100	--	100	1
9	Internship	--	Internship	If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters								
				Total	**10**	**14**	**06**	**21**	**380**	**420**	**800**	**20**

Note: PCC: Professional Core, PEC: Professional Elective, OEC: Open Elective

Professional Elective -2

Course code under18IP73X	Course Title
18IP731	Marketing Management
18IP732	Automobile Engineering
18IP733	Human Resource Management

Professional Elective -3

Course code under18IP74X	Course Title
18IP741	Non–Conventional Machining Processes
18IP742	Design of Experiments
18IP743	Just In Time Manufacturing

Open Elective -B

18IP751	Project Management
18IP752	Automotive Engineering
18IP753	Enterprise Resource Planning

Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the Programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the Programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Project work:
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multi-disciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the Mini-Project work shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-Project shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-project:
(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/ complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VIII SEMESTER: INDUSTRIAL ANDPRODUCTION ENGINEERING

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Durations in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18IP81	Supply Chain Management	IPE/MECH	2	2	--	03	40	60	100	3
2	PEC	18IP82X	Professional Elective-4		2	2	--	03	40	60	100	3
3	Project	18IPP83	Project Phase -2		--	--	2	03	40	60	100	8
4	Seminar	18IPS84	Technical Seminar		--	--	2	03	100	--	100	1
4	Internship	18IPI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
				Total	**04**	**04**	**04**	**15**	**260**	**240**	**500**	**18**

Note: PCC: Professional Core, PEC: Professional Elective

Professional Elective -4

Course code under 18IP64X	Course Title
18IP821	Advanced Joining Process and NDT
18IP822	Facility Planning and Design
18IP823	Automation in Manufacturing

Project Work:

CIE procedure for Project Phase -2:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Project Phase -2:

(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/ complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8thsemester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

B. E. COMMON TO ALL PROGRAMMES
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

Course Code	**18MAT31**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	**03**	Exam Hours	03

Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transforms: Definition and Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function – problems.
Inverse Laplace Transforms: Inverse Laplace transform - problems, Convolution theorem to find the inverse Laplace transform (without proof) and problems, solution of linear differential equations using Laplace transform.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis, examples from engineering field.

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.
Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform. Simple problems.

Module-4

Numerical Solutions of Ordinary Differential Equations (ODE's): Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Range - Kutta method of fourth order, Milne's and Adam-Bashforth predictor and corrector method (No derivations of formulae), Problems.

Module-5

Numerical Solution of Second Order ODE's: Runge -Kutta method and Milne's predictor and corrector method.(No derivations of formulae).
Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Course Outcomes: At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5:Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition, 2016
Reference Books				

1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6th Edition, 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11th Edition,2010
4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

MECHANICS OF MATERIALS

Course Code	**18IP32**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- Explain the basic concepts of stress, strain, behaviour of engineering materials under different loading conditions.
- Calculate principal stresses using analytical and graphical methods, shear force and bending moments, deflection and slop of beams, critical loads for different type of columns using Euler"s and Rankine's equations
- Plot shear force and bending moment diagrams for beams carrying different types of loads, and various support conditions
- Determine deflection and slope of beams subjected to various type of loads
- Compare solid and hollow shafts subjected to torque.

Module-1

Simple Stress and Strain:

Introduction, Stress and types, Strain, Tensile test on a mild steel bar, Hooke's Law and Poisson's ratio, Stress-Strain relation for cast iron and non-ferrous materials, Extension / Shortening of bars — uniform cross section, with cross sections varying in steps, with continuously varying cross sections (circular and rectangular), Principle of superposition, Elongation due to self weight. Volumetric strain, expressions for volumetric strain for bars with uniform circular and rectangular cross sections, Simple shear stress and shear strain, Elastic constants (No derivation for relationship between elastic constants), Temperature stresses (excluding compound bars). Simple numerical problems on tensile test and determining change in dimensions.

Module-2

Principal stresses:

Stresses in a tensile member, Stresses due to pure or simple shearing, mutually perpendicular direct stresses, Principal planes and stresses, Two-dimensional stress system, Graphical method (Mohr's circle) for plane stresses.

Thick and Thin Cylinder:

Stresses in thin cylinders, change in dimensions of cylinder (diameter, length and volume). Thick cylinders - Lame's equations for radial and hoop stresses (compound cylinders and spherical shells not included).

Torsion of Circular Shafts:

Introduction, Torsion equation — assumptions and derivation, Torsional rigidity / Stiffness of shafts. Power transmitted by solid and hollow circular shafts, Simple numerical problems.

Columns:

Introduction, End conditions, Assumptions in deriving Euler's equations, Sign conventions for bending moments, Euler's

Module-3

Bending Moment and Shear Force in Beams:

Introduction - types of beams, loads and reactions, Shear force and bending moment, Sign conventions, Relationship between load intensity, shear force and bending moment; Shear force and Bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.

Module-4

Bending Stresses in Beams:

Moment of inertia and section modulus for different sections (I, T, rectangular, and circular —only formulas) Introduction to theory of simple bending, assumptions in simple bending theory, Bending stress equation - relationship between bending stress and radius of curvature, relationship between bending moment and radius of curvature; Moment carrying capacity of a section. Simple problems on rectangular, symmetrical I (about NA) and T sections. (composite / notched beams not included).

Module-5

Deflection of Beams:

Introduction, Differential equation for deflection (flexure), Sign conventions and assumptions, Equations for deflection and slope - Double integration method and Macaulay's method for cantilever and simply supported beams for point load, uniformly distributed load, uniformly varying load, and couple.

Course Outcomes:

At the end of the course the student will be able to:

- Explain the basic concepts of stress, strain, behaviour of engineering materials under different loading conditions.
- Calculate principal stresses using analytical and graphical methods, shear force and bending moments,

deflection and slop of beams, critical loads for different type of columns using Euler's and Rankine's equations

- plot shear force and bending moment diagrams for beams carrying different types of loads, and various support conditions
- Determine deflection and slope of beams subjected to various type of loads
- Compare solid and hollow shafts subjected to torque.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Fundamentals of Strength of Materials	P N Chandramouli	PHI Learning Pvt. Ltd	2013
2	Strength of Materials	R K Rajput	S. Chand and Company Pvt.	2014
Reference Books				
3	Mechanics of Materials	R C Hibbeler	Pearson	Latest edition
4	Mechanics of Materials	James M Gere	Thomson Learning	Latest edition
5	Mechanics of Materials	Ferdinand Beer, Russell Johston, John Dewolf, David Mazurek	McGraw Hill Education (India) Pvt. Ltd	Latest edition

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

BASIC THERMODYNAMICS

Course Code	**18IP33**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Define work, heat, and laws of thermodynamics.
- Evaluate thermal performance of refrigeration cycles.
- Demonstrate the calculation of efficiency of gas power and vapor power cycles.

Module-1

Fundamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic ;Processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

Work and Heat: Definition of work and its limitations. Thermodynamic definition of work; examples, sign convention.

Module-2

Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law tonon - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat at constant pressure.

Module-3

APPLICATION OF FIRST LAW OF THERMODYNAMICS: Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer.

SECOND LAW OF THERMODYNAMICS —Qualitative difference between heat & work; Cyclic heat engine; Energy Reservoirs; Kelvin-Planck statement of the Second law of Thermodynamics; Clausius's statement of Second law of Thermodynamics; (Equivalence of two statements not included)

Module-4

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles. Introduction To Gas Turbine And Its Classification.

Module-5

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test. Real Gases: Introduction. Van-der Waal's Equation of state, Vander Waal's constants in terms of critical properties, Law of corresponding states,compressibilityfactor; compressibility chart.

Course Outcomes:

At the end of the course the student will be able to:

- Define work, heat, and laws of thermodynamics.
- Evaluate thermal performance of refrigeration cycles.
- Demonstrate the calculation of efficiency of gas power and vapor power cycles

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Basic Engineering Thermodynamics	A.Venkatesh	Universities Press	2008

2	Basic and Applied Thermodynamics	P.K.Nag	Tata McGraw Hill Pub	2nd Ed., 2002
Reference Books				
3	Thermodynamics, An Engineering Approach	Yunus A. Cenegal and Michael A.Boles	Tata McGraw Hill publications	2002
4	Engineering Thermodynamics	J.B.Jones and G.A.Hawkins	John Wiley and Sons	
5	Fundamentals of Classical Thermodynamics	G.J.VanWylen and R.E.Sonntag	Wiley Eastern.	

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

MECHANICAL MEASUREMENTS

Course Code	**18IP34**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: To

- Explain significance of mechanical measurements, elements of a generalized measuring system, theory and working principle of measuring instruments for the measurement of force, torque, flow, temperature, pressure and strain
- Define Metrology, appreciate the objectives of Metrology, and explain the importance of standards.
- Interpret the limits specified, identify fits and explain the concept of tolerance
- Use comparators, screw and gear metrology

Module-1

Standards of measurement: Definition and Objectives of metrology, Standards of length International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M81, M-12), Numerical problems on building of slip gauges.

Module-2

System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

Comparators and Angular measurement:

Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numerical on building of angles), clinometers.

Module-3

Interferometer and screw thread, gear measurement: Interferometer, interferemetry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Tool maker's microscope, gear. to. terminology, use of gear tooth vernier caliper and micrometer.

Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysterisis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Module-4

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters

Module-5

Measurement of force, torque and pressure: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic merijbers, Bridgeman gauge, Mcloed gauge, Pirani gauge.

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.

Course Outcomes:

At the end of the course the student will be able to:

- Explain significance of mechanical measurements, elements of a generalized measuring system, theory and working principle of measuring instruments for the measurement of force, torque, flow, temperature, pressure and strain
- Define Metrology, appreciate the objectives of Metrology, and explain the importance of standards.
- Interpret the limits specified, identify fits and explain the concept of tolerance
- Use comparators, screw and gear metrology

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
-

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechanical Measurements	Beckwith Marangoni and	Pearson Education	6th Ed., 2006. 2
2	Engineering Metrology	R.K. Jain,	Khanna Publishers	1994
Reference Books				
3	Engineering Metrology	I.C. Gupta	DhapatRai Publications,	
4	Mechanical Measurements,	R.K. Jain		
5	Industrial Instrumentation	Alsutko, Jerry. D.	Thompson Asia Pvt. Ltd	2002

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

FLUID MECHANICS

Course Code	**18IP35**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: To

- Define fluid properties; describe Pascal's law, Hydrostatic law.
- Calculate total pressure given point and between sections of pipe, Buoyancy and Stability of floating objects.
- Apply Bernoulli's principle to solve fluid flow problems. Make dimensional analysis of fluid mechanics problems.
- Analyze various forces acting on submerged bodies.

Module-1

Properties of Fluids: Introduction, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitations

Fluid Statics: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

Module-2

Buoyancy and Fluid Kinematics: Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height theoretically.

Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and

Module-3

Fluid Dynamics: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

Fluid Flow Measurements : Venturimeter, orifice meter, pitot-tube, vertical orifice, V Notch and rectangular notches

Module-4

Flow through pipes: Minor losses through pipes. Darey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL (no problems).

Flow past immersed bodies : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness

Module-5

Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude(theory and no problems)

Introduction to compressible flow: Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid on plates.

Course Outcomes: At the end of the course the student will be able to:

- Define fluid properties; describe Pascal's law, Hydrostatic law.
- Calculate pressure given point and difference in pressure between sections of pipe, Buoyancy and Stability of floating objects.
- Apply Bernoulli's principle to solve fluid flow problems.
- Make dimensional analysis of fluid mechanics problems
- Analyze various forces acting on submerged bodies

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Fluid Mechanics and Fluid Power	Kumar.D.S, Kataria and Sons		2004.
2	Fluid Mechanics	Dr. Bansal	R.K.Lakshmi Publications	2004
Reference Books				

3	Fluid Mechanics and hydraulics	Dr.Jagadishlal	Metropolitan Book CoLtd.,	1997
4	Fluid Mechanics (SI	Yunus A. Cingel John M.Oimbala	Tata Mac GrawHill	2006
5	Fluid Mechanics	John F.Douglas, Janul and M.Gasiosek and john A.Swaffield	Pearson Education Asia	5th ed., 2006

B.E INDUSTRIAL AND PRODUCTING ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

MANUFACTURING PROCESS - I

Course Code	**18IP36**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: To

- Define various terms associated with casting processes
- Explain methods of construction of moulds.
- Select moulding machine and moulding process based on material type
- Select appropriate joining process, type of joints.
- Explain different non-destructive testing method

Module-1

CASTING PROCESS

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process &steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance .Classification of patterns.

Sand Moulding: Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Binder: Definition, Types of binder used in moulding sand. Additives: Need, Types of additives used and their properties

Module-2

Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.

Concept of Gating & Risers: Principle and types. Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies. **Moulding Machines:** Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.

Special moulding Process: Study of important moulding processes, No bake moulds, Flaskless moulds, Sweep mould, CO2 mould, Shell mould, Investment mould.

Module-3

Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.

Melting Furnaces: Classification of furnaces. Constructional features &working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace

Module-4

WELDING

Welding process: Definition, Principles, Classification, Application, Advantages& limitations of welding.

Arc Welding: Principle, Metal Arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes (AHW).

Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction &working. Forward and backward welding

Module-5

Special types of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

Inspection Methods: Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection

Course Outcomes:-

At the end of the course the student will be able to:

- Define various terms associated with casting processes
- Explain methods of construction of moulds, different non-destructive testing methods.
- Select moulding machine and moulding process based on material type
- Select appropriate joining process and type of joints

Question paper pattern:

- The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Manufacturing Process-I	Dr.K. Radhakrishna	Sapna Book House	5th Revised Edition 2009.
2	Manufacturing & Technology Foundry Forming and Welding	P.N.Rao	Tata McGraw Hill	3rd Ed., 2003
Reference Books				
3	Process and Materials of Manufacturing	Roy A Lindberg	Pearson Education	4th Ed.. 2006
4	Manufacturing Technology	SeropeKalpakjian, Steuen. R. Sechmid	Pearson Education Asia	5th Ed. 2006

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

FOUNDRY AND FORGING LABORATORY

Course Code	**18IPL37**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: To

- To apply knowledge of foundry and forging for the conduct of exercises in Foundry and Forging laboratory using standard working procedures
- To explain various foundry and forging tools and demonstrate their usage

Sl. No	Exercises
1	**PART- A** **Testing of Moulding Sand and Core Sand:** Preparation of sand specimens and conduction of the following tests: a) Compression, Shear and Tensile tests on Universal Sand Testing Machine. b) Permeability test c) Core hardness &Mould hardness tests. d) Sieve Analysis to find Grain Finest number of Base Sand e) e. Clay content determination in Base Sand
2	**PART- B** **Foundry Practice:** a) Use of foundry tools and other equipment. b) Preparation of molds using two molding boxes using patterns or without patterns. (Split pattern, Match plate) c) Preparation of one casting (Aluminium or cast iron-Demonstration only)
3	**PART – C** **Forging Operations :** Calculation of length of the raw material required to do the model. Preparing minimum three forged models involving upsetting, drawing and bending operations. Out of these three models, at least one model is to be prepared by using Power Hammer.

Course Outcomes: At the end of the course the student will be able to:

- To apply knowledge of foundry and forging for the conduct of experiments in Foundry and Forging laboratory using standard test procedures
- To explain various foundry and forging tools and demonstrate their usage

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Question paper pattern:

1. One question is to be set from Part-A –(Procedure+ Execution): 5+25=30 marks
2. One question is to be set from either Part-B or Part-C:(Marking/Calculation+ Model):(10+40) = 50 Marks
3. Viva – Voce: 20 marks
4. Total: (30+50+20) = 100 marks

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

METROLOGY AND MEASUREMENTS LABORATORY

Course Code	**18IPL38**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives: To

- Identify the measuring instrument and demonstrate its usage
- Calibrate pressure sensor, thermocouple, LVDT and load cell
- Explain the usage of slip gauges for calibration of vernier caliper, height gauge and micrometer
- Determine the form tolerance (cylindricity and circularity)
- Determine thread and gear parameters using standard tests

Sl. No	Experiments
1	**PART-A: MECHANICAL MEASUREMENTS** 1. Calibration of Pressure Gauge (Bourdon tube pressure gauge) 2. Calibration of Thermocouple 3. Calibration of LVDT 4. Calibration of Load cell 5. Determination of modulus of elasticity of a mild steel specimen using Strain gauges.
2	**PART-B: METROLOGY** 1. Measurements using Optical Projector / Toolmaker Microscope. 2. Measurement of angle using Sine Center / Sine bar / bevel protractor 3. Measurement of alignment using Autocollimator / Roller set 4. Measurement of cutting tool forces using a. Lathe tool Dynamometer b. Drill tool Dynamometer. 5. Measurement of Screw threads Parameters using Two wire or Three-wire method. 6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator 7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer 8. Calibration of Micrometer using slip gauges 9. 9. Measurement using Optical Flats

Course Outcomes: At the end of the course the student will be able to:

- Identify the measuring instrument and demonstrate its usage
- Calibrate pressure sensor, thermocouple, LVDT and load cell
- Explain the usage of slip gauges for calibration of vernier caliper, height gauge and micrometer
- Determine the form tolerance (cylindricity and circularity)
- Determine thread and gear parameters using standard tests

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination:

ONE question from part -A: 30 Marks; ONE question from part-B: 50 Marks; Viva -Voice: 20 Marks; Total: 100 Marks

B. E. Common to all Programmes
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER –II / III / IV

Aadalitha Kannada

Course Code	**18KAK28/39/49**	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)		
Credits	01		

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ. ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಪರಿವಿಡಿ (ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)

ಅಧ್ಯಾಯ – 1 ಕನ್ನಡಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ.

ಅಧ್ಯಾಯ – 2 ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ.

ಅಧ್ಯಾಯ – 3 ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.

ಅಧ್ಯಾಯ – 4 ಪತ್ರ ವ್ಯವಹಾರ.

ಅಧ್ಯಾಯ – 5 ಆಡಳಿತ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 6 ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ – 7 ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧ ರಚನೆ (ಪ್ರಿಸೈಸ್ ರೈಟಿಂಗ್), ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ.

ಅಧ್ಯಾಯ – 8 ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ.

ಅಧ್ಯಾಯ – 9 ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ.

ಅಧ್ಯಾಯ – 10 ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಫಲಿತಾಂಶಗಳು:

- ಆಡಳಿತ ಭಾಷೆ ಕನ್ನಡದ ಪರಿಚಯವಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳು ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – ಅಐಇ **(ಅಟಿಣಟಿಟಿಣಠಾ ಐಟಿಣಜಟಿಟಿಟಿ ಇಠಟಿಣಟಿಟಿಣಟಿ):**
ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

B. E. (Common to all Programmes)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER –II & III/IV

Vyavaharika Kannada

Course Code	**18KVK28/39/49**	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)		
Credits	01		

Course Learning Objectives:
The course will enable the students to understand Kannada and communicate in Kannada language.

Table of Contents:

Course Outcomes:
At the end of the course, the student will be able to understand Kannada and communicate in Kannada language.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ – ಅಖಇ **(ಅಟಿಣಟಿಣಠಿಣಾ ಖಟಿಣಜಡಿಟಿಚಟ ಇಚಟಿಣಚಿಣಟಿ):**
ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೆ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

ಖಿಜ್ಞಾಛಜ್ಞಾ (ಪಠ್ಯಪುಸ್ತಕ): ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಗಿಥಿಚಿಜಚಿಟಿಚಿಡಿಜ್ಞಾಚಿ ಏಚಿಟಿಟಿಚಿಜಚಿ ಖಿಜ್ಞಾಣ ಃಡಜ್ಞಾ)

ಸಂಪಾದಕರು

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

B. E. COMMON TO ALL PROGRAMMES
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)

Course Code	**18CPC39/49**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Course Learning Objectives: To

- know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
- Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
- Know about the cybercrimes and cyber laws for cyber safety measures.

Module-1

Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.

Module-2

Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,371J) for some States.

Module-3

Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.

Constitutional special provisions: Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

Module-4

Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institutionof Engineers (India): Profession, Professionalism, and ProfessionalResponsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering

Module-5

Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.

Course Outcomes: On completion of this course, students will be able to,

- CO1: Have constitutional knowledge and legal literacy.
- CO2: Understand Engineering and Professional ethics and responsibilities of Engineers.
- CO3: Understand the the cybercrimes and cyber laws for cyber safety measures.

Question paper pattern for SEE and CIE:

- The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ).
- For the award of 40 CIE marks, refer the University regulations 2018.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, and et al	Cengage Learning India	2018

2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
Reference Books				
3	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall,	2008.
4	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall,	2004

B. E. Common to all Programmes
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ADDITIONAL MATHEMATICS – I

(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B.Tech. programmes)

Course Code	**18MATDIP31**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	60
Credits	0	Exam Hours	03

Course Learning Objectives:

- To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus.
- To provide an insight into vector differentiation and first order ODE's.

Module-1

Complex Trigonometry: Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).
Vector Algebra: Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

Module-2

Differential Calculus: Review of elementary differential calculus. Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions, problems.
Partial Differentiation: Euler's theorem for homogeneous functions of two variables. Total derivatives - differentiation of composite function. Application to Jacobians of order two.

Module-3

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.

Module-4

Integral Calculus: Review of elementary integral calculus. Statement of reduction formulae for $\sin^n x, \cos^n x, and\ \sin^m x \times \cos^n x$and evaluation of these with standard limits-Examples. Double and triple integrals, problems.

Module-5

Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: Variable Separable methods, exact and linear differential equations of order one. Application to Newton's law of cooling.

Course Outcomes: At the end of the course the student will be able to:

- CO1: Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
- CO2: Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
- CO3: Analyze position, velocity and acceleration in two and three dimensions of vector valued functions. CO4: Learn techniques of integration including the evaluation of double and triple integrals.
- CO5: Identify and solve first order ordinary differential equations.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43rd Edition, 2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2015
2	Engineering Mathematics Vol.I	RohitKhurana	Cengage Learning	2015

B. E. COMMON TO ALL PROGRAMMES
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

Course Code	**18MAT41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.

Construction of analytic functions: Milne-Thomson method-Problems.

Module-2

Conformal transformations: Introduction. Discussion of transformations:$w = Z^2, w = e^z, w = z + \frac{1}{z}, (z \neq 0)$.Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Module-4

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b, y = ax^b and y = ax^2 + bx + c.$

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

Course Outcomes: At the end of the course the student will be able to:

- Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
- Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition,2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C.Barrett	McGraw-Hill	6th Edition 1995

2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill	11th Edition,2010
4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

18IP42COMPUTER AIDED MACHINE DRAWING

Course Code	**18IP42**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:0:4)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives: To

- Use tools of drafting and modeling software
- Draw the sections of solids, orthographic views of simple machine parts using software
- Sketch and explain various thread forms and their application.
- Calculate parameters related to riveted joints and sketch them.
- Create solid models and draw the sectional views of automotive systems.

PART-A

Module-1

Introduction: Review of graphic interface of the software. Basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing. Drawing units, grid and snap.
Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.
Orthographic views: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

Module-2

Thread forms: Thread terminology, forms of threads – BSW Thread, Sellers thread, ISO Metric thread, square and Acme thread. Conventional representation of threads.
Fasteners: Hexagonal headed bolt and nut with washer (assembly), square-headed bolt and nut with washer (assembly). Types of Bolt heads, special types of nuts, locking of nuts, Studs, set screws, grub screws.

PART-B

Module-3

Keys, cotter and knuckle joints: Types of Keys, Cotter and knuckle Joints
Riveted Joints: lap joints- single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets).

Module-4

Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

PART-C

Module-5

Assembly drawing of following machine parts (3D parts to be created and assembled and then getting 2D drawing with required views, along with 3D part drawings).

1. Plummer block (Pedestal Bearing)
2. Screw jack (Bottle type)
3. Machine vice
4. Tool Post (Square Shape) of a Lathe

Course Outcomes: At the end of the course the student will be able to:

- Use tools of drafting and modeling software
- Draw the sections of solids, orthographic views of simple machine parts using software
- Sketch and explain various thread forms and their application.
- Calculate parameters related to riveted joints and sketch them.
- Prepare assembly drawing from the list of components.
- Create solid models and draw the sectional views of automotive systems.

- **Internal assessment (CIE): 40 Marks**
  All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.
- **Scheme of Examination (SEE):** Two questions each are to be set from Parts A, B, and C. Student has to answer one question from each Part. Marks Allotment shall be as follows:
  PART-A: 1x20 = 20Marks; PART-B: 1x30 = 30Marks; PART-C: 1x50 = 50 Marks; Total = 100 Marks

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year

Textbook/s				
1	Machine Drawing	K. R. Gopala Krishna	Subhash Publication.	
2	A Primer on Computer Aided Machine Drawing		Published by VTU	
Reference Books				
3	A Text Book of Computer Aided Machine Drawing	S. Trymbaka Murthy	CBS Publishers, New Delhi	2007
4	Machine Drawing with Auto CAD	Goutam Purohit & GouthamGhosh	1st Indian print Pearson Education,	2005
5	Machine Drawing	N. Siddeshwar, P. Kanniah, V. V. S.	Tata Mc GrawHill,	2006

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

KINEMATICS OF MACHINES

Course Code	**18IP43**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Define and explain the basic terms such as kinematic chain, kinematic pair, degree of freedom etc. associated with kinematics of machinery, inversions of four bar mechanism, single slider crank mechanism and double slider crank mechanism.
- Determine the mobility of given mechanisms.
- Determine the velocity and acceleration of links using graphical as well as analytical methods.
- Plot cam profiles using displacement diagram for various types of motions.
- Define gear terminology and determine the velocity ratio in different gear trains.

Module-1

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

Module-2

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle

Module-3

Velocity and acceleration analysis of mechanisms: Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles .in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

Module-4

Gears & gear trains:
Gear terminology, Law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio of Spur, Helical, Bevel and Worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.
Types of Gear trains, velocity ratio, Train value, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

Module-5

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

Course Outcomes: At the end of the course the student will be able to:

- Define and explain the basic terms such as kinematic chain, kinematic pair, degree of freedom etc. associated with kinematics of machinery, inversions of four bar mechanism, single slider crank mechanism and double slider crank mechanism.
- Determine the mobility of given mechanisms.
- Determine the velocity and acceleration of links using graphical an analytical methods.
- Plot cam profiles using displacement diagram for various types of motions.
- Define gear terminology and determine the velocity ratio in different gear trains

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				

1	Theory of Machines	Rattan S. S.	Tata McGraw-Hill Publishing Company Ltd., New Delhi	3rd edition - 2009
2	Theory of Machines	Sadhu Singh	Pearson Education (Singapore) Pvt. Ltd, Indian Branch New	2006
Reference Books				
3	Theory of Machines & Mechanisms	J. J. Uicker, , G.R. Pennock, J.E.	OXFORD	3rd Ed., 2009
4	Mechanism and Machine theory	Ambakar,	PHI	

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

MANUFACTURING PROCESS- II

Course Code	**18IP44**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Explain the nomenclature of single point cutting tool, mechanics of chip formation, tool failure criteria and to solve problems on evaluation of tool life
- Construction and working of various systems in a Lathe, Shaper, Planeing and Drilling machine
- Classify grinding and milling machines and explain their construction
- Explain the principles of broaching
- Select non-traditional machining process for given application

Module-1

Classification of metal removal process and machines: Concept of orthogonal and oblique cutting Geometry of single point cutting tool and tool angles, tool nomenclature.
Mechanism of Chip Formation: Type of chips. Mechanics of metal cutting, Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation

Module-2

Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip.
Turning (Lathe), Shaping Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shapingMachine. Different operations on lathe, shaping machine

Module-3

Drilling machines: drilling & related operations, Classification of drilling machine, constructional features and working principle of Radial, multi spindle, Gang, Deep hole and automatic drilling machine, Types of drill & drill bit nomenclature.
Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.
Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing

Module-4

Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Center less, cylindrical and surface grinding).
Broaching process - Principle of broaching. Details of a broach.Typesofbroachingmachinesconstructionaldetails.Applications.Advantages and Limitations.

Module-5

Finishing and other Processes: Lapping and Honing operations Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.
Non-traditional machining processes: Need for non-traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

Course Outcomes: At the end of the course the student will be able to:

- Explain the nomenclature of single point cutting tool, mechanics of chip formation, tool failure criteria and to solve problems on evaluation of tool life
- Construction and working of various systems in a Lathe, Shaper, Planeing and Drilling machine Classify grinding and milling machines and explain their construction
- Explain the principles of broaching
- Select non-traditional machining process for given application

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Workshop Technology	HazaraChoudhry	Media Promoters & Publishers Pvt. Ltd.	Vol-II, 2004
2	Production Technology	R. K. Jain	Khanna Publications	2003
Reference Books				
3	Manufacturing Science	Amitabh Ghosh and	affiliated East West Press	2003
4	Fundamentals of Metal Machining and Machine	G. Boothroyd	McGraw Hill	2000
5	Production Technology	HMT	Tata MacGraw Hill	2001

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

MATERIAL SCIENCE AND METALLURGY

Course Code	**18IP45**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- The foundation for understanding the structure and behavior of materials common in mechanical engineering.
- Topics to explore the mechanical properties of metals and their alloys, polymers, ceramics, smart
- materials and composites
- To understand modifications of material properties by heat treatment processes
- Selections of different materials for various applications are highlighted
- Impart knowledge of various failure modes of materials

Module-1

Crystal Structure
Unit Cells, Crystal systems, BCC, FCC, and HCP structures, Coordination number and atomic packing factors Crystal Imperfection-Point, line and surface imperfections
Atomic Diffusion
-Fick's laws of diffusion, Factors affecting Diffusion, Steady and non-steady state diffusions

Module-2

Dislocation
Characteristics of dislocations slip systems, slip in single crystals, Plastic deformation of polycrystalline materials, Deformation by twinning
Fracture
Types of fracture, ductile and brittle fracture, Ductile to brittle transition temperature
Fatigue and creep
Cyclic stresses, SN curves, crack initiation and propagation, Factors

Module-3

Phase Diagrams
Solid solutions, Hume Rothary rules-substitutional, and interstitial solid solutions, Intermediate phases, Gibbs phase rule, Construction of equilibrium diagrams, lever rule Iron carbon equilibrium diagram Description of phases, Solidification of steels and cast irons, Invariant reactions, TTT curves, Continuous cooling curves

Module-4

Heat Treatment of Metals
Annealing and its types, normalizing, Hardening, tempering, Martempering, Austempering, Hardenability, surface hardening methods like carburizing, cyaniding, Nitriding, Flame hardening and induction hardening. Age hardening of Aluminium –Copper alloys Recovery,
Recrystallization and Grain Growth
Recrystallization temperature, Annealing temperature v/s cold-worked and recovered grains, Direction of grain boundary motion, time v/s grain diameter

Module-5

Steels and cast irons
Ferrous alloys, steels – low medium and high carbon, AISI designation steels, Cast irons – types and properties Composites and ceramics
Composite materials:
Definition, classification, Types of matrix materials & reinforcements, Application of composites, Ceramics: Glasses, Glass – ceramics, clay products, Refractories, abrasives and cements.

Course Outcomes: At the end of the course the student will be able to:

- Understand the mechanical properties of metals and their alloys.
- Analyze the various modes of failure and understand the microstructures of ferrous and nonferrous materials.
- Describe the processes of heat treatment of various alloys.
- Acquire the Knowledge of composite materials and their production process as well as applications
- Understand the properties and potentialities of various materials available and material selection procedures.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	"An Introduction -Material's Science and Engineering",	William D Callister,	John Wiley and Sons India Pvt Ltd.	6th Edition, 2006 New Delh
2	Foundation of Material Science and Engineering	Smith	McGraw Hill	3rd Edition, 1997
Reference Books				
3	Physical Metallurgy, Principles and Practices	V Raghavan	PHI	2nd Edition 2006, New
4	-Elements of Material Science and Engineering	H. Van Black and Addison	Wesley Edition,	1998
5	Introduction to Material Science for Engineering	James FShackelford	Pearson Prentice hall, New Jersey	6th edition, 206

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

CAD/CAM

Course Code	**18IP46**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- know the fundamentals of CAD
- Information regarding various CAD hardware
- Understand the fundamentals of CAM
- Programming concepts in CNC
- Robotics and their applications

Module-1

INTRODUCTION: Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment. Introduction to CAD, Introduction to CAM. Advantages and disadvantages of CAD and CAM.
HARDWARE IN CAD: Basic Hardware structure, working principles, usage and types of hardware for CAD - input and output Devices, memory, CPU, hardcopy and Storage devices.

Module-2

COMPUTER GRAPHICS: Software configuration of a graphic system, function of a Graphics package, construction of geometry, wire frame and solid modelling, CAD/CAM integration. Describe modelling facilities. Introduction to exchange of modeling data – Basic features of IGES, STEP, DXF,DMIS.
NC, CNC, DNCTECHNOLOGY: NC, CNC, DNC modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC.

Module-3

CNC TOOLING: Turning tools geometry, milling tooling systems, tool presetting, ATC work holding.
CAM PROGRAMMING: Overview of different CNC machining centers, CNC turning centers, high speed machine tools, MCE.

Module-4

CNC PROGRAMMING: Part program fundamentals – steps involved in development of a part program. Manual part programming, milling, turning center programming

Module-5

INTRODUCTION TO ROBOTICS: Introduction, Robot Configuration, Robot Motions, Programming the Robots, Robot- Programming Languages, End effectors, Work Cell, Control and Interlock, Robot Sensor, Robot Applications.

Course Outcomes: At the end of the course the student will be able to:

- Understand the concepts of CAD and the required hardware
- Understand CAM and CNC machines
- Program CNC machines
- Understand and program the robot

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	CAD / CAM Principles and	P.N.Rao	TMH, New Delhi	2002
2	CAD/CAM	Mikell P-groover, Emory W. Zimrners	Jr Pearson Education inc	2003
Reference Books				
3	CAD-CAM	Chris McMahon &Jimrnie Browne	Pearson education Asia	2001
4	Computer Aided Manufacturing	P.N.Rao, N.K.Tewari and T.K. Kundra	Tata McGraw Hill	1999
5	NC Machine programming & software Design	Chno-Hwachang, Michel.A.Melkanoff	Prentice Hall,	1989

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

MACHINE SHOP

Course Code	**18IPL47**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To provide an insight to different machine tools, accessories and attachments.
- To train students into fitting machining operations to enrich their practical skills
- To inculcate team qualities and expose students to shop floor activities.
- To educate students about ethical, environmental and safety standards

Sl. No	Experiments
1	**PART – A** Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.
2	**PART – B** Cutting of V Groove/ dovetail / Rectangular groove using a shaper. Cutting of Gear Teeth using Milling Machine.

Course Outcomes: At the end of the course the student will be able to:

- Understand integral parts of lathe, shaping and milling machines and various accessories and attachments used thereof.
- Select cutting parameters like cutting speed, feed, depth of cut, and tooling for various machining operations.
- Perform cylindrical turning operations such as plain turning, taper turning, step turning, thread Cutting, facing, knurling, internal thread cutting, eccentric turning and estimate cutting time.
- Perform machining operations such as plain shaping, inclined shaping, keyway cutting, Indexing and Gear cutting and estimate cutting time.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Scheme of Examination: : (Model: 80 Marks; Viva-voce: 20 Marks; Total: 100 Marks)

B.E INDUSTRIAL & PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Course Code	**18IPL48**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
- To understand mechanical behavior of various engineering materials by conducting standard tests.
- To learn material failure modes and the different loads causing failure.
- To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

Sl. No	Experiments
	Part-A
1	Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of Heat treated samples
3	To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4	Non-destructive test experiments like, (a). Ultrasonic flaw detection (b).Magnetic crack detection (c). Dye- Penetration testing. To study the defects of Cast and Welded specimens
	PART – B
5	Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
6	Torsion Test
7	Bending Test on metallic and nonmetallic specimens
8	Izod and Charpy Tests on M.S,C.I Specimen
9	Brinell, Rockwell and Vickers's Hardness test.
10	Fatigue Test (Demonstration only)

Course Outcomes: At the end of the course the student will be able to:

- Acquire experimentation skills in the field of material testing.
- Develop theoretical understanding of the mechanical properties of materials by performing experiments.
- Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.
- Apply the knowledge of testing methods in related areas.
- Understand how to improve structure/behavior of materials for various industrial applications.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
5. Scheme of Examination:

ONE question from part -A: 30 Marks; ONE question from part -B: 50 Marks; Viva –Voice: 20 Marks; Total: 100 Marks.

B. E. COMMON TO ALL PROGRAMMES
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

ADDITIONAL MATHEMATICS – II

(Mandatory Learning Course: Common to All Branches)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech programmes)

Course Code	**18MATDIP41**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	60
Credits	00	Exam Hours	03

Course Learning Objectives:

- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

Module-1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.

Module-2

Numerical Methods: Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's one third rule and Weddle's rule (without proof) Problems.

Module-3

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[Particular Integral restricted to $R(x) = e^{ax}, \frac{sinax}{cosax}, x^n \; for \; f(D)y = R(x)$.

Module-4

Partial Differential Equations (PDE's): Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Module-5

Probability: Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes's theorem, problems.

Course Outcomes: At the end of the course the student will be able to:

- Solve systems of linear equations using matrix algebra.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Apply the knowledge of numerical methods in modelling and solving of engineering problems.
- Classify partial differential equations and solve them by exact methods.
- Apply elementary probability theory and solve related problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	43rd Edition, 2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition, 2015
2	Engineering Mathematics Vol. I	Rohit Khurana	Cengage Learning	2015.

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MANAGEMENT AND ENTREPRENEURSHIP

Course Code	**18IP51**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand the basic concepts of management, planning, organizing and staffing.
- Acquire the knowledge to become entrepreneur.
- Comprehend the requirements towards the small-scale industries and project preparation.

Module-1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, and Development of Management Thought - early management approaches - Modem management approaches.

PLANNING: Nature, importance and purpose of planning process Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans

Module-2

ORGANIZING AND STAFFING: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing— :Process of Selection & Recruitment.

DIRECTING & CONTROLLING: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control.

Module-3

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development t; Entrepreneurship in India; Entrepreneurship – its Barriers.

Module-4

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry

Module-5

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC**.**

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; ProjectAppraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

Course Outcomes: At the end of the course the student will be able to:

- Explain about the management and planning.
- Apply the knowledge on planning, organizing, staffing, directing and controlling.
- Describe the requirements towards the small-scale industries and project preparation.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				

1	Principles of Management	P. C.Tripathi, P.N. Reddy	Tata McGraw Hill,	
2	Dynamics of Entrepreneurial Development & Management	Vasant Desai	Publishing House	
3	Entrepreneurship Development	Poornima. M. Charantimath	Small Business Enterprises - Pearson	2006 (2 & 4)
Reference Books				
4	Management Fundamentals- Concepts, Application , Skill	RobersLusier - Thomson		
5	Entrepreneurship Development	S.S.Khanka	S.Chand& Co	
6	Management	Stephen Robbins	Pearson Education/PHI	17th Edition, 2003

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

DESIGN OF MACHINES ELEMENTS

Course Code	**18IP52**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

Module-1

DESIGN FOR STATIC STRENGTH: Design considerations; Codes and Standards, static loads and factor of safety. Theories of failure: Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion energy theory. Failure of Brittle and Ductile materials. Stress concentration. Determination of stress concentration factor.

Module-2

DESIGN FOR FATIGUE STRENGTH: S – N Diagram, low cycle and High cycle fatigue. Endurance limit. Modifying factors: Load, Size and Surface finish effects. Fatigue stress concentration factor. Fluctuating stresses. Goodman and Soderberg Relationship. Stresses due combined loading, Cumulative fatigue damage

Module-3

DESIGN OF SHAFTS: Design of shafts subjected to torsion, bending moment and combined torsion moment and axial loading. ASME and BIS Codes for design of transmission shafting. Design for strength and rigidity. Shafts under fluctuating loads and combined loads

Module-4

DESIGN OF GEARS: Introduction to Spur, Helical and Bevel Gears. Design of Spur gear, Lewis equation, form factor, stresses in gear tooth, Dynamic load and wear load

Module-5

RIVETED JOINTS AND WELDED JOINTS: Types of riveted joints, failures of riveted joints, Boiler joint, Efficiency. Types of welded joints, Strength of butt and fillet welds, eccentrically loaded welds.
DESIGN OF SPRINGS: Types of springs, Stresses in Coil springs of circular and non-circular cross-sections. Tension and compression springs. Stresses in Leaf springs.

Course Outcomes: After completing the course a student
1.able to understand various forces acting on a body
2. will be able to design shafts, gears, springs
3 will be able to design various kind of joints
4 will be able to put together all the above and design a complex machine

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechanical Engineering Design	Joseph Edward Shigley	Tata McGraw Hill	New Delhi - 1986
2	Machine Design	VL. Maleev and Hartman	CBS Publishers and Distributors Delhi -	1983
3	Design of Machine Elements	V. B. Bahandari	Tata McGraw Hill, New Delhi	2000
Reference Books				
4	Machine Design	Robert. L. Norton	Pearson Education Asia,	New Delhi - 2001
5	Theory and Problems of Machine Design	Hall, Holowinko, Laughlin Schaums	Outline Series	2002
6	Elements of Machine Design	N. C. Pandey and C. S. Shah	Chorotar Publishing house	2002

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

QUALITY ASSURANCE AND RELIABILITY

Course Code	**18IP53**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand the fundamentals of Quality tools and techniques
- To apply the quality and reliability tools and techniques to real world problems
- To Interpret the results of quality and reliability study for decision making

Module-1

Introduction: Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality costs – four categories costs and hidden costs. Brief discussion on sporadic and chronic quality problems.
Quality Assurance: Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. Structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality program.

Module-2

Statistical Process Control: Introduction to statistical process control – chance and assignable causes variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC. Process capability – Basic definition, standardized formula.
Control Charts for Attributes: Controls chart for defectives ('p' and 'np' charts) and defects ('c' and 'u'

Module-3

Control Charts for Variables: Controls charts for X bar and Range, statistical basis of the charts, development and use of X bar and R charts, interpretation of charts. Control charts for X bar and standard deviation (S), development and use of X bar and S chart. Brief discussion on – Pre control Xbar and S control charts with variable sample size, control charts for individual measurements, cusum chart, moving-range charts

Module-4

Sampling Inspection: Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection,producer risk and consumer risk, published sampling plans

Module-5

Statistical Theory of Tolerances: Application of statistical theory of tolerances to design of tolerances in random assemblies and application in other areas.
Reliability and Life Testing: Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations

Course Outcomes: At the end of the course the student will be able to:

- Understand the fundamentals of Quality tools and techniques
- Apply the quality and reliability tools and techniques to real world problems
- Interpret the results of quality and reliability study for decision making

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Introduction to statistical Quality Control	D C Montgomery	John Wiley and Sons	3rd Edition
2	Quality Planning & Analysis	J M Juran, Frank M	Tata McGraw Hill	3rd edition
3	Total Quality Management	NVR Naidu, KM Babu and G. Rajendra	New Age International Pvt. Ltd	2006
Reference Books				

4	Statistical Quality Control	Grant and Leavenworth, McGraw Hill	6th Edition	
5	Total Quality Management	Kesavan R	I.K. International, New	2007
6	ISO 9000 a Manual for Total Quality Management	Suresh Dalela and Saurabh	S. Chand and Co.	1st Edition

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

HYDRAULICS AND PNEUMATICS

Course Code	**18IP54**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To Study the fundamentals of Hydraulic Power Pumps, Actuators and Motors.
- To develop a sound knowledge of control components in Hydraulic Systems.
- To have basic skills to design Hydraulic Circuits and analyze them.
- To acquire the fundamental knowledge on pneumatic control.
- To develop skill sets to handle Pneumatic Actuators , Valves, Pneumatic circuits and logic circuits

Module-1

Introduction to Hydraulic Power and Pumps: review of fluid mechanics, Pascal's Law, structure of hydraulic control system. pumps: pumping theory, pump classification, gear pumps- external and internal type, vane pumps- simple, balanced, pressure compensated types, piston pumps- radial and axial (both swash plate and bent axis type), pump performance.

Hydraulic Actuators and Motors: Linear hydraulic actuators - single acting, double acting, tandem cylinder, telescopic rod cylinder, mechanics of hydraulic cylinder loading, cylinder cushioning, hydraulic rotary actuators,

Module-2

Control Components in Hydraulic Systems: directional control valves (DCV), constructional features, 2/2,3/2,4/2,4/3 DCV, center configuration in 4/3 DCV- open, closed, tandem, regenerative, floating centre configuration, actuation of DCVs- manual, mechanical, solenoid, and indirect actuation, relays for the solenoid operation, check valve, pilot check valve, pressure control valves – direct and pilot operated types, pressure reducing valve, flow control valves- fixed throttle and variable throttle, throttle check valve, pressure

Module-3

Hydraulic Circuit Design and Analysis: control of single and double acting hydraulic cylinder, regenerative circuit, counter balance valve application, cylinder sequencing circuits, cylinder synchronizing circuits, speed control of hydraulic cylinder – meter in and meter out, speed control of hydraulic motors, relay circuit design for the operation of solenoid directional control valve- single and double solenoid relay circuit

Module-4

Introduction To Pneumatic Control: choice of working medium, characteristics of compressed air, structure of pneumatic control system , supply, signal generators, signal processor, final control elements , actuators, production of compressed air – compressors - reciprocating and rotary type, preparation of compressed air – driers, filters, regulators,

Module-5

Pneumatic Actuators , Valves: linear cylinder – types, conventional type of cylinder – working, directional control valve, shuttle valve, quick exhaust value, twin pressure valve, direct and indirect actuation of pneumatic cylinder, memory valve, time delay valve.

Pneumatic circuits and logic circuits: supply air and exhaust air throttling, will dependent circuits, travel dependent controls – types – construction – practical applications, cylinder sequencing circuits, travel step diagrams, practical examples involving two or three cylinders, use of logic functions – OR, AND, NOR, NAND,YES, NOT functions in pneumatic applications, practical examples involving the use of logic functions

Course Outcomes: At the end of the course the student will be able to:

- Recall the basic concept of fluid mechanics; identify different components of hydraulic system
- Analyze the requirement of control components and their selection

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
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Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Fluid Power with applications	Anthony Esposito	Pearson edition	2000
2	Oil Hydraulics	Majumdar S.R.,	TalaMcGRawHllL,	2002

3	Pneumatic systems- “Principles and Maintenance”	Majumdar S.R	ata McGraw-Hill, New Delhi	2005
Reference Books				
4	Hydraulics and pneumatics	Andrew Par	Jaico Publishing House	2005
5	Industrial Hydraulics	John Pippenger, Tyler Hicks	McGraw Hill	International Edition, 1980.
6	Hydraulic Control Systems	Herbert E. Merritt.	John Wiley and Sons, Inc	

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

WORK STUDY AND ERGONOMICS

Course Code	**18IP55**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To develop concepts related to principles of productivity & work study as a tool for increasing the efficiency and effectiveness in organizational systems.
- To study the existing method, compare and propose a new method.
- To provide the usage of the various tools and techniques used in work measurement.
- To develop basic ideas of ergonomics and its design.
- To develop concepts related Man-Machine Interfaces and Design of Displays and controls

Module-1

Productivity and Work Study: Definition of productivity, task of management, productivity of materials, land, building, machine and power, factors affecting the productivity, work content, basic work content, excess work content, how manufacturing job is made up, work content due to excess product and process, ineffective time due to short comings on part of the management.
Definition, Objective and scope of Work Study: Work study and management, work study and worker

Module-2

Method Study: Definition, objective and scope of method study, activity recording and tools,
Recording tools: Out Line Process Chart, Flow Process Chart, Flow diagram, String Diagram, Travel Chart, Multiple Activity Chart, Two- Handed process chart.
Principles of Motion Economy: Introduction, Classification of movements. Two- hand process chart, Micro motion study, Therbligs, SIMO Chart. Special Charts: Cyclegraph and Chronocycle graph - development, definition and installation of the improved method.
Work Measurement: Definition, objectives, and work measurement techniques.
Work sampling – Need, confidence levels, and sample size determination, conducting study with problems

Module-3

Time study - Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information.
Rating: Systems of rating, standard rating, standard performance, scales of rating.
Allowances: Standard time determination, predetermined motion time study (PMTS), factors affecting rate of working, problems on allowances.

Module-4

Introduction to Ergonomics: Human factors and ergonomics, psychology, engineering, bio mechanics, industrial design, graphics design, statistics, operation research and anthropometry Morphology of design and its relationship with cognitive abilities of human being.
Physical Ergonomics: human anatomy, and some of the anthropometric, physiological and bio mechanical characteristics as they relate to physical activity. Cognitive: mental processes, such as perception, memory, reasoning, and motor response, mental workload, and decision-making. Organizational ergonomics: optimization of socio-technical systems, including their organizational structures, policies, processes. Communication, work design, design of working times, teamwork, cooperative work, and new work programs. Environmental ergonomics**:** human interaction with the environment- characterized by climate, temperature, pressure, vibration, light.

Module-5

Man-Machine Interaction; Man-Machine interaction cycle, Man-machine interfaces, Displays : factors that control choice of display, visual displays qualitative displays; moving pointer displays, moving scale displays, digital displays Indicators, auditory displays, tactile displays. Factors affecting effectiveness of displays. Quantitative displays, check- reading displays, representational displays. Types of controls and their integration with displays.
Design guidelines for displays and controls: viewing distance, Illumination, angle of view, reach etc., general design checklist for displays and controls. Standards for ergonomics in engineering and design, displays and controls.

Course Outcomes: At the end of the course the student will be able to:

- Recollect the basic concepts of productivity, work content and work study and define the objective and scope of Work Study.
- Define the various charts and to construct the charts on the basis of present method and develop a new / proposed method and identify the unnecessary movements.
- Explain the basic work measurement techniques and to gain knowledge of measurement of work, rating and imbibe the concept of allowance in estimating Standard Time

- Determine the basic concepts of Ergonomics and demonstrate a sound knowledge of Ergonomics in engineering applications.
- Demonstrate a sound knowledge of Man-Machine Interfaces and design of displays and controls in engineering systems

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Introduction to Work Study	ILO,		4th edition 1992
2	Human Factor in Engineering and Design	Mark. S. Sanders and Ernest. J	McGraw-Hill Book Co., Inc., New York	1993
Reference Books				
3	Work Study and Ergonomics	S. Dalela and Sourabh	Standard publishers	2013
4	Human Factors Design Handbook	Wesley Woodson, Peggy Tillman and	McGraw-Hill	2ndedition, 1992
5	Motion and Time Study	Ralph M. Barnes	Wiley International	7th Edition.

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

COMPOSITE MATERIALS

Course Code	**18IP56**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Course Learning Objectives Missing

Module-1

Introduction to composite materials

Definition, classification and characteristics of composite materials: Fibrous, laminate, particulate, flake composites. Properties and types of reinforcement and matrix materials. Fibre reinforced plastic processing: basic steps in manufacturing of a composite, impregnation, lay-up, consolidation and solidification. Open and closed mould process, hand lay-up techniques, structural laminate vacuum bag and autoclave processing, filament winding, pultrusion, pulforming, thermo-forming, injection molding, resin transfer molding.

Module-2

Fabrication of composites

Cutting: machining, drilling, mechanical fasteners and adhesive bonding: design guidelines for adhesive bonding. Mechanical joining: design parameters for bolted joints, waterjet and laserjet cuttings. Challenge during machining of composites, failure mode during machining. Cutting tools and fabrication equipment. Ceramic matrix composites and their fabrication technologies.

Module-3

Structural application of composites

Aerospace, air craft and military, medical, sporting goods and recreation, automotive. Marine, infrastructure. Micro analysis of a uni-directional lamina: definition of volume and mass fractions, density and void content. Derivation for longitudinal, transverse and shear modulus. Major and minor Poission'sratio's. Numerical problems

Module-4

Study properties of MMC's

Physical Mechanical, wear, machinability and other properties. Effect of size, shape and distribution of particulate on properties. Advanced composites such as Polymer based Sandwich structures. Introduction to shape memory alloys.

Module-5

Study of composite materials from natural resources

Introduction to natural composites: classification of natural fibers: plant, animal, mineral fibers and their sources; silk, human, feather, jute, sisal, flax, cotton, bamboo fibres. Advantages and disadvantages of natural fibres. Characteristics of natural fibres. Extraction of plant fibres. Recent developments in natural fibre composites, feature potential of natural fibre composites

Course Outcomes: At the end of the course the student will be able to:

- Understand the composite materials
- Find properties of composite materials and its impact
- Will be able to fabricate composite material

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Composite Science and Engineering	K.K.Chawla	Springer Verlag	1998
2	Introduction to composite materials	Hull and Clyne	Cambridge University Press	2nd Edition, 1990
3	Composites Manufacturing: materials, product and process	Sanjay K. Mazumdar	CRC press	First edition 2010
Reference Books				
4	Composite Materials hand book	MeingSchwaitz	McGraw Hill Book Company	1984

5	Forming Metal hand book		ASM handbook	9th edition, V15, 1988, P327-338
6	Mechanics of composites	Autar K kaw	CRC Press	2002

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MECHANICAL AND FLUID POWER LAB

Course Code	**18IPL57**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Sl. No	Experiments
	PART-A (FLUID POWER LAB)
1	a) Study of components of Hydraulic circuit. b) Study of symbols for components in hydraulic circuits
2	Testing of Pump
3	Testing of Flow Control Valve
4	Speed control of Piston in Forward and Return stroke with Meter in Meter out circuit
5	Study of Regenerative circuit and study of Bleed of circuit
6	Study of Variation of Flow with pressure and with throttle
7	Building of Circuits using different kinds of Valves
	PART-B (MECHANICAL ENGINEERING LAB) (At least Four experiments)
8	Determination of viscosity of lubricating oil using Redwoods and Saybolt – Viscometers
9	Flash and Fire point of given oil
10	Performance Tests on Four stroke Petrol and Diesel Engines, Calculations of IP, BP, thermal efficiencies, SFC, FP and heat balance sheet
11	Multi cylinder petrol / diesel engine (Morse test).
12	Performance test on Centrifugal or Reciprocating pumps
13	Study of flow through pipes for fluid transport

Course Outcomes: At the end of the course the student will be able to:

- Understand the properties of a fluid.
- Will be able to handle and design complex hydraulic circuits
- Understand the various parameters affecting a engine

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
5. Scheme of Examination: experiments from Parts A and B = 80 Marks; Viva-voce =20 Marks

B.E INDUSTRIAL AND PRODUCTION ENGINEERING

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER - V

WORK STUDY AND ERGONOMICS LAB

Course Code	**18IPL58**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Sl. No	**Experiments**
	PART – A (METHOD STUDY)
	Recording Techniques**:** Preparing the following charts and diagrams (Minimum 3 Charts) Outline process chart Multiple Activity Chart Flow process chart and Flow diagram String diagram, Experiments on the Application of principle of motion economy, Two handed process chart. Exercises on conducting method study for assembling simple components and office work. Development of Layout plans using SLP technique. Experiments on Line balancing.
	PART – B (WORK MEASUREMENT)
1	Rating practice using: walking simulator, pin board assembly, dealing a deck of cards and marble collection activity
2	Determining the standard time for simple operations using stopwatch time study
3	Exercises on estimating standard time using PMTS
4	Determination of standard time using PDA device and time study software
5	Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
6	Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergo meter
7	Effect of Noise, Light, Heat on human efficiency in work environments.

Course Outcomes: Course Outcomes Missing

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
5. Scheme of Examination: experiments from Parts A and B = 80 Marks; Viva-voce =20 Marks

B. E. COMMON TO ALL PROGRAMMES
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – V

ENVIRONMENTAL STUDIES

Course Code	**18CIV59**	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course Outcomes: At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Question paper pattern:

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012
2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2nd Edition, 2005
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11th Edition, 2006

3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh& Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1st Edition

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

COMPUTER INTEGRATED MANUFACTURING

Course Code	**18IP61**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To learn the basic concepts of Computer Integrated Manufacturing and the benefits that can be achieved by integrating technology with manufacturing systems.
- To have a fundamental knowledge of CNC Machine Tools.
- To imbibe the basic knowledge of Robotics and their application to production
- To develop the fundamental skill sets in CNC Programming
- To inculcate the fundamental knowledge CIM, Group Technology and Flexible Manufacturing

Module-1

Introduction: Role of computers in design and manufacturing, influence of computers in manufacturing environment, product cycle in conventional and computerized manufacturing environment, introduction to CAD/CAM/CIM,
NC Technology: NC, CNC, DNC modes, NC elements, advantages and limitations of NC and CNC.

Module-2

CNC Machine Tools: Turning tool geometry, milling tooling systems, tool presetting, ATC, work holding, CNC machine tools, overview of different CNC machining centers, CNC turning centers.

Module-3

Introduction to Robotics: Introduction, robot configuration, robot motions, programming the robots, robot programming languages, end effectors, work cell, control and interlock, robot sensor

Module-4

CNC Programming: Steps involved in development of a part program, manual part programming-milling and turning, ISO programming in drilling, milling and turning with numerical problems.

Module-5

CIM: Computer aided process planning, computer integrated production planning system, material requirements planning, capacity planning, shop floor control.
Group Technology and Flexible Manufacturing: Part families, part classification and coding, machine cell design and benefits of group technology, FMS work stations, planning the FMS, FMS layout configuration

Course Outcomes: At the end of the course the student will be able to:

- Outline the use of computers and NC technology in CIM systems.
- Understand the concepts of CNC machine tool technology.
- Comprehend the applications of robots in CIM.
- Develop CNC programs for turning and milling operations.
- Plan and control the CIM systems effectively. Apply the GT and FMS in actual manufacturing practice

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	CAD/CAM Principles and Applications	P.N. Rao	TMH, New Delhi	2002
2	CAD/CAM	Mikell P-groover, Emory W.Zimrners	Jr Pearson Education inc,	2003
Reference Books				
3	CAD/CAM/CIM	P.Radhakrishnan, S.Subramanyan,	New Age International Publication	Revised Third Edition 2007
4	NC Machine programming and software Design	Chno-Hwachang, Michel.A.Melkanoff		Prentice Hall, 1989.
5	CAD/CAM	Ibrahim Zeid	Tata McGraw Hill	1999

6	Computer Aided Manufacturing	P.N.Rao, N.K.Tewri and T.K.Kundra	Tata McGraw Hill	1999
7	An Introduction to NC/CNC machines	S. Vishal	S.K. Kataria and Sons	2nd edition,2010

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

OPERATIONS RESEARCH

Course Code	**18IP62**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
- To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery

Module-1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

Solution of Linear Programming Problems: The simplex method, canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

Module-2

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Least Time Transportation Problems.

Assignment Problem: Formulation, types, application to maximization cases and Travelling Salesman Problem, flight scheduling problem.

Module-3

Project Management using Network Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects (network construction by AOA approach can be used for all the cases).

Module-4

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models (no derivations) and their steady state performance analysis.

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

Module-5

Sequencing: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines

Course Outcomes: At the end of the course the student will be able to:

- Understand the meaning, definitions, scope, need, phases and techniques of operations research.
- Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
- Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
- Solve problems on game theory for pure and mixed strategy under competitive environment.
- Solve waiting line problems for M/M/1 and M/M/C queuing models.
- Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.
- Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				

1	Operations Research - Theory and Applications -	J K Sharma	Pearson Education Pvt Ltd	Recent edition
2	Operations Research	P K Gupta and D S Hira	S Chand Publications, New Delhi	Recent edition
Reference Books				
3	Introduction to Operation Research	Taha H A	PHI / Pearson Publications	
4	Operations Research	Paneerselvan,	PHI / Pearson Publications	
5	Operations Research	S.D. Sharma	Kedarnath, Ramnath& Co	Recent edition

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

TOOL ENGINEERING AND DESIGN

Course Code	**18IP63**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To develop capability to design and select single point and multipoint cutting tools for various machining operations.
- Exposure to variety of locating and clamping methods available
- To enable the students to design jigs and fixtures for simple components
- To expose the students to the design/selection procedure of press tools and die casting dies.

Module-1

Introduction: Concept, meaning and definitions of tool, tool design and tool engineering. Tools-types, classification, features & applications.
Design of Single Point Tool: Tool Signature, Selection of Tool Angles, Design of shank section for single point tool to account for strength and rigidity. Design of Multi Point Tools – Drill, Reamers.

Module-2

DESIGN of peripheral Milling cutters, Design of Broach.
Location and Clamping: General principles of location, 3-2-1 Principle of Location, Principle of Radial location, General study of locating devices. General principles of clamping, Study of various Clamping devices.

Module-3

Design of Fixtures: Difference between a Jig and a Fixture, Design of Milling fixture, Study of other fixtures like Lathe fixture, Inspection fixture. Study of different types of Drill jigs.
Design of Gauges: Types of gauges. Factors to be considered in the design of gauges, Design of Plug gauge, Design of Snap gauge.

Module-4

Design of Press Tools: A General study of Press operations. Elements of a Die, Strip layout, calculation of center of pressure. Design of Blanking Die, Design of Piercing Die, Design of Progressive Die**.**

Module-5

Design of Forming Dies: Study of Drawing and Bending process, Design of Drawing Die, Design of Bending Die
Tool Layout and Cam Design of Single Spindle Automats: Classification of Automats and their applications. Tool layout and Cam design for automatic screw cutting machine.

Course Outcomes: At the end of the course the student will be able to:

- Select appropriate cutting tools required for producing a component.
- Understand and interpret cutting tool and tool holder designation systems
- Select suitable locating and clamping devices for a given component for various operations.
- Analyze and design a jig/fixture for a given simple component.
- Understand various press tools and press tool operations.
- Classify and explain various die casting and injection moulding dies.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Text book of Production Engineering	P. C. Sharma	Chorotar Publishing house	
2	Tool Design	Donaldson and Golding	Tata McGraw Hill, New Delhi	
Reference Books				
1	Fundamentals of Tool Design	ASTME		
2	Jigs and Fixtures	P.H.Joshi	McGraw Hill Education	3rd edition, 2010.
3	An introduction to Jig and Tool design	Kempester M.H.A.,	VIVA Books Pvt.Ltd	2004

4	Fundamentals of Tool Design	Frank	PHI publications.	

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

THEORY OF METAL FORMING

Course Code	**18IP641**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Module-1

Basics of plastic deformation & Introduction to metal forming process

Concept of true stress and true strain. Flow stress and strain hardening. Tresca's and Von-Mise's yield criteria and yield surface. Factors affecting yield strength of materials. Forming properties of materials. Ductility and formability. Classification of forming processes. Importance of temperature in metal forming. Hot and cold working. Effect of strain rate. Friction and its role in metal forming. Different methods of analysis of metal forming.

Module-2

Forging & Rolling Processes

Open-die and close-die forging processes. Brief description of the forging machines, equipments and heating furnaces. Slab analysis of upset forging of rectangular slab under plane strain condition. Forging load calculation. Common forging defects. Different types of rolling mills. Geometrical considerations in rolling. Role of friction in rolling and neutral point location. Simplified methods for calculating rolling load, torque and power required for rolling. Effect of back and front tension on rolling force. Residual stresses in rolling and common rolling defects.

Module-3

Extrusion & drawing of rods, wires and tubes

Types of extrusion processes. Metal flow pattern in extrusion. Extrusion equipments and dies. Extrusion of hollow sections. Slab analysis of extrusion of strips and circular sections and calculation of force and power required for extrusion. Common extrusion defects. Drawing equipments and dies. Analysis of rod or wire drawing and calculation of draw force and power required. Maximum possible reduction in drawing. Tube drawing using different types of mandrels, residual stresses and defect in drawn products.

Module-4

Sheet metal working, sheet metal drawing

Classification of sheet metal working and equipments used Blanking and Piercing operation – Die design, cutting force required, slitting, trimming and shaving operations. Bending operation – Types of bending. Bend angle, bend radius, bend allowance and force required for bending. Spring back effect in bending. Roll bending process. Brief description of spinning and stretch forming processes. Die design, Number of draws required, Blank size calculation, and drawing force necessary. Drawability and defects in drawn products.

Module-5

High Energy Rate Forming (HERF)

Introduction, advantages, limitations and applications of HERF: Process description, parameters of Explosive forming, Electro discharge forming, Electromagnetic forming and Electro Hydraulic Forming. Newer forming processes: laser beam and plasma arc. Die less forming of sheet metal.

Course Outcomes: At the end of the course the student will be able to:

- Understand various metal forming process
- Analyze various forces acting on the products
- Analyze the energy requirements

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechanical Metallurgy	Dieter G.E	McGraw Hill publication	
2	Fundamentals of Metal Forming Processes	Juneja B.L	New age International	
3	Principle of Industrial Metal Working Processes	Rowe Edward	CBS Publication	

Reference Books				
1	Materials and Processes in Manufacturing	E.Paul, DeGarmoetal	PHI publication	
2	Fundamentals of Working of Metals	Sach G.	Pergamon press	
3	Mechanics of sheet metal forming	Z.Marciniak, J.L.Duncanand S.J. Hu	Elsevier-Butterworth-Heinemann-2006	

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

ENGINEERING ECONOMY

Course Code	**18IP642**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire a clear understanding of the fundamentals of engineering economics.
- To learn the concepts of decision making, problem solving, and comparison of the alternatives and elements of cost.
- To inculcate an understanding of concept of money and its importance in the evaluation of projects.
- To illustrate concept of money and its importance in evaluating the projects.
- To evaluate the alternatives based on the present annual worth and equivalent annual worth methods

Module-1

Introduction: engineering decision – makers, engineering and economics, problem solving, intuition and analysis, tactics and strategy with an example.
Interest and Interest Factors: Interest rate, simple interest compound interest, interest formulae, time value equivalence exercises, problems and discussion

Module-2

Present Worth Comparison: Conditions for present worth comparisons, rule 72, and basic present worth comparisons, present worth equivalence, net present worth, assets with equal and unequal lives, comparison of assets assume to have infinite lives, exercises and problems.
Equivalent Annual Worth Comparisons: Situations for equivalent annual worth comparison, net annual worth of a single project, comparison of net annual worth's, definitions of asset life, comparison of assets with equal and unequal lives, exercises and problems.

Module-3

Depreciation: Introduction, Reasons for Depreciation, Various methods of depreciation, Numerical Problems on all the methods of Depreciation

Module-4

Replacement Analysis: Introduction**,** Reasons for Replacements - Deterioration, obsolescence, inadequacy, replacement criteria problems, Replacements of assets considering and ignoring time value of money. Group Replacements. Numerical Problems on the above types of Replacement Problems.

Module-5

Estimating and Costing: components of costs such as direct material cost, direct labour cost, Fixed, over – heads, factory costs, administrative – over heads, first cost, selling price, calculation of the total cost of various components, mensuration, estimation of simple components.

Course Outcomes: At the end of the course the student will be able to:

- Recall the basic concepts of decision making, problem solving, tactics and strategy.
- Defining the time value of money concept, interest formulae.
- Explain the comparison by present worth method for different lives of the asset. Compare the asset on the basis of EAW comparison.
- Explain the concepts of depreciation and replacement criteria.
- Calculate the total cost of a component and explain the process for estimating simple components

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Engineering economy	Riggs J.L.	McGraw Hill	2002
2	Engineering economy	Paul Degarmo	Macmillan Pub, Co.	2001
Reference Books				
1	Engineering Economy	NVR. Naidu, KM Babu and	New Age International Pvt. Ltd	2006

2	Industrial Engineering and Management	O.P Khanna	DhanpatRai and Sons	2000
3	Financial Management	I M Pandey	Vikas Publishing House	2000
4	Engineering Economy	Theusen G.	PHI	2000

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SEMESTER - VI

TOTAL QUALITY MANAGEMENT

Course Code	**18IP643**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand various approaches to TQM
- Understand the characteristics of quality leader and his role.
- Develop feedback and suggestion systems for quality management.
- Enhance the knowledge in Tools and Techniques of quality management.

Module-1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM. Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

Module-2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

Module-3

Customer Satisfaction and Customer Involvement: Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies. Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, Performance appraisal, unions and employee involvement, case studies.

Module-4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.
Statistical Process Control : Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

Module-5

Tools and Techniques: Benching marking, information technology, quality management systems, environmental management system, and quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

Course Outcomes: At the end of the course the student will be able to:

- Explain the various approaches of TQM
- Infer the customer perception of quality
- Analyze customer needs and perceptions to design feedback systems.
- Apply statistical tools for continuous improvement of systems
- Apply the tools and technique for effective implementation of TQM.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Total Quality Management	Dale H. Besterfield	Pearson Education India	ISBN:8129702606, Edition 03
2	Total Quality Management for Engineers	M. Zairi	head Publishing	SBN:1855730243
Reference Books				
1	Managing for Quality and Performance Excellence	James R. Evans and W M	Cengage Learning	9th edition,
2	A New American TQM, four revolutions in management	Shoji Shiba, Alan Graham,	Productivity press, Oregon,	1990

3	Organizational Excellence through TQM,	H. Lal	New age Publications	2008
4	Engineering Optimization Methods and Applications	A Ravindran, K, M. Ragsdell	Willey India Private Limited,	2nd Edition,2006.
5	Introduction to Operations Research- Concepts and Cases	F.S. Hillier. G.J. Lieberman	Tata McGraw Hill	9th Edition, 2010

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SEMESTER - VI

OPEN ELECTIVE - A

VALUE ENGINEERING

Course Code	**18IP651**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

INTRODUCTION TO VALUE ANALYSIS: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, uses, Applications, advantages and limitations of Value analysis. Symptoms to apply value analysis, Coaching of Champion concept.

TYPE OF VALUES: Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in cost reduction. Value analysis procedure by simulation. Detailed case studies of simple products.

Module-2

FUNCTIONAL COST AND ITS EVALUATION: Meaning of Function and Functional cost, Rules for functional definition, Types of functions, primary and secondary functions using verb and Noun, Function evaluation process, Methods of function evaluation. Evaluation of function by comparison, Evaluation of Interacting functions, Evaluation of function from available data, matrix technique, MISS technique, Numerical evaluation of functional relationships and case studies.

PROBLEM SETTING & SOLVING SYSTEM: A problem solvable stated is half solved, Steps in problem setting system, Identification, Separationand Grouping of functions. Case studies.

PROBLEM SETTING & SOLVING SYSTEM: Goods system contains everything the task requires. Various steps in problem solving, case studies.

Module-3

VALUE ENGINEERING JOB PLAN: Meaning and Importance of Value Engineering Job plan. Phases of job plan proposed by different value engineering experts, Information phase, Analysis phase, Creative phase, Judgment phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal.

Module-4

VALUE ENGINEERING TECHNIQUES: Result Accelerators or New Value Engineering Techniques, Listing, Role of techniques in Value Engineering, Details with Case examples for each of the Techniques.

ADVANCED VALUE ANALYSIS TECHNIQUES: Functional analysis system technique and case studies, Value analysis of Management practice (VAMP), steps involved in VAMP, application of VAMP to Government, University, College, Hospitals, School Problems etc., (service type problems).

TOTAL VALUE ENGINEERING: Concepts, need, Methodology and benefits.

Module-5

APPLICATION OF VALUE ANALYSIS: Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.

Course Outcomes: After the completion of the course, a student will

1. Able to understand the importance of value of a product
2. Find out unnecessary cost/ function involved in the product
3. Conduct value engineering methodology
4. Do value analysis using advanced value engineering techniques
5. Become a certified value engineer with additional course /training

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Techniques of Value Analysis and Engineering	Lawrence D. Miles	McGraw – Hill Book Company	2nd Edn.
2	Value engineering for Cost Reduction and Product	M.S. Vittal	Systems Consultancy Services Edn	1991
3	Value Management, Value Engineering and Cost Reduction	Edward D Heller	Addison Wesley Publishing Company	1971
Reference Books				
4	Value Analysis for Better Management	Warren J Ridge	American Management Association Edn	1969

5	Getting More at Less Cost (The Value Engineering Way)	G.Jagannathan	Tata Mcgraw Hill Pub. Comp. Edn	1995
6	Value Engineering	Arther E Mudge	McGraw Hill Book Comp. Edn	1981

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SEMESTER - VI

OPEN ELECTIVE - A

ADVANCED MACHINING PROCESS

Course Code	**18IP652**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To learn the fundamental concepts of Non-Traditional Machining and their Mechanical Processes
- To have a good knowledge of Abrasive Jet Machining and its application
- To learn the fundamental principles of Electrochemical Machining Process (ECM)
- To have basic exposure to Chemical Machining (CHM) and Chemical Milling
- To imbibe a the basic principles of Thermal Metal Removal Processes, Plasma Arc Machining (PAM)and Laser Beam Machining (LBM)

Module-1

Introduction: History, need for non-traditional machining processes, classification, process selection.
Mechanical Process: Ultrasonic Machining (USM): Introduction, equipment, tool material and tool size, abrasive slurry, Magnetostriction assembly, tool cone (concentrator), exponential concentrator of circular cross section and rectangular cross sections, effect of parameters, amplitude, frequency, grain diameter, applied static load and slurry, tool and work material. USM process characteristics: material removal rate, tool wear, accuracy, surface finish, applications, advantages and disadvantages of USM.

Module-2

Abrasive Jet Machining (AJM): Introduction, equipment, variables in AJM: carrier gas, size of abrasive grain, velocity of the abrasive jet, mean no. abrasive particles per unit volume of the carrier gas, work material, stand-off distance (SOD), process characteristics-material removal rate. Nozzle wear, Accuracy and surface finish. Applications, advantages and disadvantages of AJM.

Module-3

Electrochemical Machining Process (ECM): Introduction, elements of ECM process: Cathode tool, anode work piece, source of DC power, electrolyte, chemistry of the process, ECM process characteristics - material removal rate, accuracy, surface finish, tool and insulation materials, tool size, electrolyte flow arrangement, applications, simple problems.

Module-4

Chemical Machining (CHM): Introduction, elements of the process, chemical blanking process: preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking.
Chemical Milling (Contour machining):- Process steps-masking, etching, etc. process characteristics of CHM: - material removal rate, accuracy, surface finish, application of CHM.

Module-5

Thermal Metal Removal Processes: Electrical Discharge Machining (EDM) - Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tool (electrode), electrode material selection, machining time, flushing: suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, heat affected zone, machine tool selection, applications, electric discharge grinding, travelling wire EDM.
Plasma Arc Machining (PAM): Principle of generation of plasma, equipment, non-thermal generation of plasma, selection of gas, mechanism of metal removal, PAM parameters, process characteristics.
Laser Beam Machining (LBM): Principle of generation of lasers, equipment and machining procedure, types of lasers, process characteristics, applications

Course Outcomes: At the end of the course the student will be able to:

- Understand the need for advanced manufacturing process and explain the principle of operation of ultrasonic machining process.
- Explain the characteristic features of Abrasive Jet Machining (AJM)
- Define the process parameters influence the material removal rate with the help of characteristics curves.
- Explain the principle of chemical machining and chemical milling process.
- Summarize the various aspects of Electric discharge machining (EDM).Explain the principle of generation plasma and laser and their application in machining

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	**Modern Machining Process**	P C Pandey and H S Shan	Tata McGraw Hill	2008
2	**New Technology**	Bhattacharaya	Institution of Engineering Publication	
Reference Books				
3	Production Technology	HMT	Tata McGraw Hill	
4	Modern Machining Methods	Dr. M.Adithan	Khanna Publishers	2008
5	Non-conventional Machining	P K Mishra,	Narosa publishing House, New – Delhi.	2006

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

OPEN ELECTIVE - A

MANAGEMENT INFORMATION SYSTEMS

Course Code	**18IP653**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To elevate students' awareness of information Technology and develop an in-depth and systematic understanding of key aspects of IT management.
- To help students gain a strategic perspective on business.
- To evaluate the value of emerging technologies and their competitive advantage.

Module-1

Fundamentals of Information Systems: Information systems in business, fundamentals of information systems solving business problems with information systems.

Module-2

Information Systems for Business Operations: Business information systems, Transaction processing systems, management, information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

Module-3

Issues in Managing Information Technology: Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

Module-4

E-Business Model: E-commerce frame work, Architectural frame work for e-commerce, Application services and transaction, Models – B2C Transactions, B2B Transactions, Intra-Organizational Transactions, WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web.

Module-5

Consumer Oriented E-Commerce: Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.
Electronic Data Interchange (EDI): EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

Course Outcomes: At the end of the course the student will be able to:

- Understand the awareness of information Technology and develop an in-depth and systematic understanding of key aspects of IT management.
- Explain the gain a strategic perspective on business.
- Evaluate the value of emerging technologies and their competitive advantage.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Management Information systems- managing information technology in the internet worked	Jams. A O'Brien	Tata McGraw Hill publishing company limited	2002
2	Management Information Systems	Laaudon&Laudo	PHI	ISBN 81-203-1282-
Reference Books				
3	Management Information systems	S. Sadogopan	PHI	1998Edn. ISBN 81-203-1180-9
4	Information systems for modern management	G.R. Murdick	PHI	2nd Edition.

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SEMESTER - VI

CAD/CAM LAB

Course Code	**18IPL66**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Sl. No.	Exercises
	PART-A
	Modeling of simple machine parts using Graphics Package Study of Finite Element Analysis Package - 1D, 2D, Structural problems, Evaluation of displacement (Strain) and Stress. Problems involving Beams and Trusses
	PART-B
	Modeling and Simulation of Machining process of simple machine parts using CAM packages. Suggested Software Packages: Solid Works/ Uni Graphics/Catia and MASTER CAM or any other similar packages
	Note: A minimum of 12 exercises are to be conducted.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero
5. Scheme of Examination: Exercises from Parts A and B = 80 Marks; Viva-voce =20 Marks.

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SEMESTER - VI

MACHINE TOOL LAB

Course Code	**18IPL67**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Sl. No	Exercises
	PART-A
1	Machining of T - slot or L- slot on milling machine and Checking a. Parallelism between the surfaces. b. Perpendicularity between surfaces
2	Exercise on Spur Gear cutting and Measurement of all the parameters of the gear.
3	Machining of Spiral slots on milling machine.
4	Measurement of Cutting forces, Determination of Shear angle, Chip Thickness Ratio and Verification of Merchants Angle Relationship in Turning Operation.
5	Study the variation of Axial force and Torque in Drilling with respect to cutting speed and feed
	PART-B
1	A General study of Acceptance test of commonly used machine tool (Theory).
2	Test for True running of the main spindle of Lathe
3	Test for True running of the main spindle of Drill
4	Alignment of centers in Vertical plane in Lathe
5	Testing for true running of Headstock center of a Lathe
6	Disassembly of a) Lathe Tail Stock , b) Tool Head of a Shaper and measurement of component dimension.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero
5. Scheme of Examination: Exercises from Parts A and B = 80 Marks; Viva-voce =20 Marks.

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SEMESTER -VI

MINI PROJECT

Course Code	**18IPMP68**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	60
Credits	02	Exam Hours/Batch	03

Course Learning Objectives:

- To support independent learning and innovative attitude
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Mini-Project: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: At the end of the course the student will be able to:

- Present the mini-project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Mini - Project:

The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for Mini - Project report shall be the same for all the batch mates.

Semester End Examination

SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

B.E INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

18IP85INTERNSHIP

All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail and shall have to complete during subsequent University examinations after satisfying the internship requirements.

Course Code	Refer to VIII semester scheme (**18IP85**)	CIE Marks	40
Duration of internship	04 weeks	SEE Marks	60
Credit	02	Exam Hours/ Batch	03

Course Learning Objectives:

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently.

Internship: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes: At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learnt to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics.

Continuous Internal Evaluation

CIE marks for the Internship shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman.

The CIE marks awarded shall be based on the evaluation of Internship Report, Presentation skill and Question and Answer session in the ratio 50:25:25.

Semester End Examination

SEE marks for the Internship shall be awarded based on the evaluation of Internship Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

B.E INDUSTRIAL ANDPRODUCTION ENGINEERING
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SEMESTER - VII

OPERATIONS MANAGEMENT

Course Code	**18IP71**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Module-1

OPERATIONS MANAGEMENT CONCEPTS: Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity.
OPERATIONS DECISION MAKING: Introduction, Management as a science, Characteristics of decisions, and Framework for decision making, Decision methodology, Decision support systems, Economic models, and Statistical models.

Module-2

FORECASTING DEMAND: Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts.

Module-3

AGGREGATE PLANNING AND MASTER SCHEDULING: Introduction- planning and scheduling, Objectives of aggregate planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.

Module-4

MATERIAL AND CAPACITY REQUIREMENTS PLANNING: Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.
SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES: Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines, Scheduling methodology, priority control, capacity control.

Module-5

SINGLE MACHINE SCHEDULING: Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule, minimizing the number of tardy jobs.
FLOW -SHOP SCHEDULING: Introduction, Johnson's rule for 'n' jobs on 2 and 3 machines, CDS heuristic. JOB-SHOP SHEDULING: Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines.

Course Outcomes:

- Apply the concepts of operations management by knowing the Historical development, Physical and information flows in a production system, and contribution of James Watt, Charles Babbage, Robert Owen, Thomas Alva Edition, Frederick Winslow Taylor, Henry Ford in development of production systems.
- Solve problems using appropriate techniques of forecast.

Apply models used in decision making, Recognize and apply basic appropriate analytical

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Operations Management	Monks J.G.	McGraw	Hill International Editions - 1987.
2	Production and Operations Management	Pannerselvam. R	PHI	2nd edition
3	An introductory book on lean systems	TPS, Yasuhiro Monden		
Reference Books				
4	Modern Production/Operations Management	Buffa	Wiely India Ltd	4th edition.
5	Production and Operations Management	Chary, S.N	TataMcGraw Hill.	3rd edition
6	Production and Operatiosn Management	Adam & Ebert	PHI	5th edition

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

MECHATRONICS

Course Code	**18IP72**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To acquire a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.
- To understand the evolution and development of Mechatronics as a discipline.
- To substantiate the need for interdisciplinary study in technology education
- Understand the applications of microprocessors in various systems and to know the functions of each element.
- To demonstrate the integration philosophy in view of Mechatronics technology
- To be able to work efficiently in multidisciplinary teams.

Module-1

INTRODUCTION: Definition of Mechatronics, Multi-disciplinary scenario, Evaluation of Mechatronics, Objectives, Advantages & Disadvantages of Mechatronics, An Overview of Mechatronics, Microprocessor Based Controllers, Principle of Working of Automatic Camera, Automatic Washing Machine & Engine Management System.

REVIEW OF SENSORS AND TRANSDUCERS: Definition and Classification of Transducers, Definition & Classification of Sensors, Working Principle and Application of Displacement, Position & Proximity, Velocity and Motion, Force, Fluid pressure, Liquid flow, Liquid level, Temperature, Light sensors, Selection of transducers.

Module-2

DIGITAL PRINCIPLES: Introduction, Digital Number System, Range and Weight of Binary Number System, Octal and Hexadecimal Number Systems, Conversion, BCD Number Systems, Gray Code, Boolean Algebra, Logic States, Logic Functions, More Logic Gates, Universal Gates, Exclusive-OR Gate, Combinational and Sequential Logic Circuits, Flip- Flops, Minimization of Boolean Expression, Karnaugh Map, TTL and CMOS, Memory.

MICROPROCESSOR: Intel 8085, ALU, Timing and Control Unit, Registers, Data and Address Bus, Pin Configuration, Intel 8085 Instructions, Op code and Operands, Instruction Word Size, Instruction Cycle, Fetch Operation, Execute Operation, Machine Cycle and State, Instruction and Data Flow, Timing Diagram, Timing

Module-3

MICRO CONTROLLER: Introduction to microcontrollers, Intel 8051 Microcontroller Architecture and Pin diagram, Selection and Application of Microcontroller.

PLC: Programmable Logic Controllers, Basic Structure, Input/Output Processing, Programming, Mnemonics, Timers, Internal Relays and Counters, Shift Registers, Master and Jump controls, Data handling, Analogue input/output, Selection of a PLC.

Module-4

ACTUATORS: Definition, Classification of Actuators, Brief survey of Electromechanical actuators, Drive requirements for cutting movements, Requirements of feed drives, Calculation of drive requirements on feed motor shaft, DC motors & Control of DC motors, AC motors, DC & AC servomotors, Stepper motors- types, Characteristics, advantages, limitations and applications.

Module-5

SYSTEM MODELS: Mathematical models, Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks, Thermal system building blocks

Course Outcomes: At the end of the course the student will be able to:

- Illustrate various components of Mechatronics systems.
- Assess various control systems used in automation.
- Develop mechanical, hydraulic, pneumatic and electrical control systems.
- Design and conduct experiments to evaluate the performance of a Mechatronics system or component with respect to specifications, as well as to analyze and interpret data.
- Function effectively as members of multidisciplinary teams.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Mechatronics	W. Bolton	Pearson Education Asia	2nd Edition, 2001
2	Fundamentals of Microprocessor and Micro Computer	B. Ram	DhanpatRai and Sons	4th Revised Edition
Reference Books				
3	Mechatronics Principles, Concepts and Application	Nitaigour and Premchand, Mahilik	Tata McGraw Hill	2003
4	Mechatronics	HMT	TMH	

B. E. INDUSTRIAL AND PRODUCTION ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

MARKETING MANAGEMENT

Course Code	18IP731	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Course Learning Objectives Missing

Module-1

INTRODUCTION: Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, importance of marketing in the India Socio – economic system.

CONSUMER MARKETS AND BUYING BEHAVIOR: Characteristics affecting consumer behaviour, Types of buying decisions, Buying decision process, Classification of consumer products, Market segmentation.

Module-2

MARKETING INFORMATION SYSTEMS AND RESEARCH: Components of marketing information system–benefits & uses marketing research system, marketing research procedure, measurement of market demand.

MARKETING OF INDUSTRIAL GOODS: Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behaviour, characteristics of industrial market demand, Determinants of industrial market demand, Buying

Module-3

PRODUCT PLANNING AND DEVELOPMENT: The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of New – product; major stages in new – product development, product life cycle.

BRANDING, LABELLING AND PACKAGING: Branding, Reasons for branding, functions of branding, features and types of brands, kinds of brand name.

LABELLING: Types, functions, advantages and disadvantages

PACKAGING: Meaning, growth of packaging, function of packaging, kinds of packaging

Module-4

PRICING: Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions.

DISTRIBUTION: Marketing channels – functions, types of channels of distribution, number of channel levels. Physical distribution – importance, total systems concept, strategy, use of physical distribution.

Module-5

PERSONAL SELLING: Objectives of personal selling, establishing the Sales force objectives, sales – force strategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major steps in effective selling.

Course Outcomes:

Course Outcomes Missing

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Principles of Marketing	Philip Kotler	Prentice Hall	11th Edn.
2	Marketing Management	Philip Kotler	Prentice Hall	11th Edn.
Reference Books				
3	Fundamentals of Marketing	Wiliam J Stanton	McGraw Hill	1984
4	Marketing Management Text & Cases	Rajagopal	Vikas Publishing House	ISBN 81-259-0773-4.
5	Marketing Management	Michael R Czinkota	Vikas Publishing House	2nd Edition ISBN 981-240-366-3.

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SEMESTER - VII

AUTOMOBILE ENGINEERING

Course Code	**18IP732**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To identify and name the various parts of an automobile.
- To recognize the effects and types of Superchargers and Turbochargers.
- To identify the various components of an Ignition System and know their functions
- To describe the Transmission system and know the use.
- To explain the modes of power transmission and indicate the types of braking

Module-1

Engine Components and Cooling & Lubrication systems: cylinder - arrangements and their relatives merits, cylinder Liners, Piston rings, connecting rod, crankshaft, valves, cooling requirements, Methods of cooling-lubrication system and Different lubrication methods.

Module-2

Super Chargers And Turbochargers: Naturally aspirated engines, Forced Induction, Supercharging of SI Engines and CI Engines, Effects of supercharging on performance of the engines, supercharging limits. Methods of supercharging, Types of superchargers, Turbocharger construction and operation.

Module-3

Ignition Systems: Introduction, Requirements of an ignition system, Battery Ignition systems components of Battery Ignition systems, magneto Ignition system rotating armature type, rotating magnet type, Electronic Ignition system

Module-4

Transmission Systems: General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, and Single plate, multi-plate and centrifugal clutches.
Gear Box - Principle of gear box, Sliding mesh gear box, constant mesh gear box, synchromesh gear box and Epicyclical gear box, over drives, fluid coupling and torque converters, principle of automatic transmission

Module-5

Drive To Wheels: Propeller shaft, universal joints, differential, rear axle drives, Hotchkiss and torque tube drives, steering geometry, power steering,
Brakes: Types of brakes, Disk brakes, drum brakes, Hydraulic brakes and Air brakes, Antilock -Braking systems, purpose and operation of antilock-braking system

Course Outcomes: At the end of the course the student will be able to:

- Explain functions of piston and piston rings, valves, cooling system and lubrication system.
- Differentiate between supercharger and turbocharger and their respective constructions.
- Understand the working principles of various ignition methods used and their operations.
- Develop the knowledge on different energy transmission systems and their applications.
- Develop the knowledge on steering types and different braking methods.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Automotive Mechanics	S. Srinivasan	Tata McGraw Hill	2003
2	Automobile engineering	Kirpal Singh.		Vol I and II 2002
Reference Books				
3	A course in I.C. Engines	M.L. Mathur and R.P.		2001
4	Internal Combustion Engines	Ganeshan	Tata McGraw Hill	2ndEdition, 2003

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SEMESTER - VII

HUMAN RESOURCE MANAGEMENT

Course Code	**18IP733**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Course Learning Objectives Missing

Module-1

INTRODUCTION: Evolution of HRM, Objectives, Functions and Policies.
HUMAN RESOURCE PLANNING: Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification

Module-2

RECRUITMENT: Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process.
SELECTION: Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion, exit interview, (Tutorial on written test, Group Discussion, Interviews)

Module-3

TRAINING AND DEVELOPMENT: Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods.
PERFORMANCE APPRAISAL: Components (all round performance appraisal), Methods. Advantages and limitations of different methods, Personal Counselling based on Annual Confidential Reports.

Module-4

COUNSELLING AND HUMAN RESOURCE ACCOUNTING: Characteristics, Need, Function, Types, Suggestions for personnel development, communication function, communication process, effective communication. Human resource records, Advantages of HR accounting, Various methods of accounting.

Module-5

INDUSTRIAL RELATIONS: Indian trade union act, standing orders act, Indian factories act
INDUSTRIAL DISPUTES AND SETTLEMENT: Indian Industrial Disputes act, Industrial disputes settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Court of inquiry, Industrial tribunal, Adjudication.

Course Outcomes:

1. Synthesize information regarding the effectiveness of recruiting methods & selection procedures
2. Identify the various training methods and design a training program
3. Design a job description and job specification for various levels of employees.

List out the regulations governing employee benefit practices.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Human Resources Management	Dr. K Ashwathappa	Tata McGraw Hill	Edition
2	Management of Human	CB Mamoria	Himalaya Publication	2003
Reference Books				
3	Personnel / Human resource Management	Decenoz and robbins	PHI	2002
4	Industrial Relations	ArunMonappa	TMH	ISBN – 0-
5	Human Resources Management	VSP Rao		
6	Human Resources Management	Ravi Dharma Rao		

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SEMESTER - VII

NON–CONVENTIONAL MACHINING PROCESSES

Course Code	**18IP741**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- The course aims in identifying the classification of unconventional machining processes.
- To understand the principle, mechanism of metal removal of various unconventional machining processes.
- To study the various process parameters and their effect on the component machined on various unconventional machining processes.
- To understand the applications of different processes.

Module-1

INTRODUCTION: History, Classification, Comparison between conventional and non conventional machining process selection.

MECHANICAL PROCESS: Ultrasonic machining (USM): Introduction, Equipment, tool materials & tool Size, Abrasive slurry, Cutting tool system design: Magnetostriction assembly, Tool cone (Concentrator), & Exponential concentrator of circular cross section & rectangular cross section Hallow cylindrical concentrator**.** Mechanics of cutting : Effect of amplitude and frequency and vibration, Effect of grain diameter , Effect of applied static load, Effect of slurry, Tool and work material, USM process Characteristics ; Material removal rate,

Module-2

ABRASIVE JET MACHINING (AJM): Introduction, Equipment, Variables in AJM: carrier Gas Type of abrasive, Size of abrasive grain, velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, standoff distance (SOD) nozzle design shape of cut.

Process characteristics – Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, Advantages & Disadvantages of AJM.

ELECTROCHEMICAL AND CHEMICAL METAL REMOVAL PROCESS: Electrochemical machining (ECM): Introduction, Study of ECM machine, Elements of ECM process: Cathode tool, Anode work piece, source of DC power, Electrolyte, ECM process characteristics – Material removal rate, Accuracy, Surface finish.

Module-3

ECM TOOLING: ECM tooling technique 7 example, Tool &insulation materials, Tool size Electrolyte flow arrangement, Handling of slug., Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Horning, deburring, Advantages, Limitations.

CHEMICAL MACHINING (CHM): Introduction, Elements of process Chemical blanking Process: - Preparation of work piece. Preparation of masters, masking with photo resists, etching for blanking, applications of chemical blanking, chemical milling (Contour machining) :- Process steps – masking, Etching, process characteristics of CHM :- material removal rate accuracy, surface finish, Hydrogen embrittlement, Advantages & application of CHM

Module-4

EDM PROCESS: Introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design : Choice of matching operation, electrode material selection, under sizing and length of electrode Machining time.

EDM PROCESS CHARACTERISTICS: Flushing – Pressure flushing synchronized with electrode movement, EDM process characteristic: Metal removal rate, Heat affected Zone, Application: EDM accessories / applications.

Module-5

PLASMA ARC MACHINING (PAM): Introduction, equipment, generation of plasma, Mechanism of Metal removal, PAM parameters, Process characteristics.

LASER BEAM MACHINING & ION BEAM MACHINING: Introduction, metal removal mechanism, advantages and application

Course Outcomes:

- Will be able to understand various machining techniques
- Compare from conventional and non-conventional machines
- Understand various methods of non-conventional machining

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				

1	Modern machining process	Pandey and Shah	TATA McGraw Hill	2000
2	Unconventional Manufacturing process	M K Singh	New age publications	ISBN 978-81-224-2244-3
Reference Books				
3	Production Technology	HMT	TATA McGraw Hill -	2001
4	Thermal Metal cutting processes	B G Ranganath	I K International Publishing house Pvt. Ltd	
5	Fundamentals of Machining and Machine Tools	R.K.Singal	I K International Publishing house Pvt. Ltd	

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SEMESTER - VII

DESIGN OF EXPERIMENTS

Course Code	**18IP742**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Course Learning Objectives Missing

Module-1

Introduction: Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.

Basic Statistical Concepts: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal &Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples.

Module-2

Experimental Design: Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical

Module-3

Analysis And Interpretation Methods: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.

Module-4

Quality By Experimental Design: Quality, Western and Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Parameter design and Tolerance Design. Reliability Improvement through experiments, Illustration through Numerical examples.

Experiment Design Using Taguchi's Orthogonal Arrays: Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

Module-5

Signal To Noise Ratio: Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples.

Parameter And Tolerance Design: Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numerical examples.

Course Outcomes: After completing this course, a student will be able to:

- Appreciate the advantages and disadvantages of a design for a particular experiment
- Construct optimal or good designs for a range of practical experiments
- Understand the potential practical problems in its implementation
- Describe how the analysis of the data from the experiment should be carried out

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Design and Analysis of Experiments	Douglas C. Montgomery	Wiley India Pvt. Ltd	5th Edition, 2007
2	Quality Engineering using Robust Design	Madhav S. Phadke	Prentice Hall PTR, Englewood Cliffs, New	
Reference Books				
3	Quality by Experimental Design	Thomas B. Barker, Marcel	Inc ASQC	Quality Press 1985.
4	Experiments Planning, analysis, and parameter Design	C.F. Jeff Wu Michael	John Wiley Editions	2002
5	Taguchi Techniques for Quality Engineering	Phillip J. Ross	McGraw Hill International Editions	2nd Edn. 1996

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SEMESTER - VII

JUST IN TIME MANUFACTURING

Course Code	**18IP743**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To know the different types of welding and describe welding and cladding of dissimilar metals
- To distinguish the weldability of metals
- To identify the welding design principles and compute welding design parameters
- To illustrate the symbols used in welding practice and identify the adhesive bonding applications
- To Identify and use the welding inspection techniques and standards

Module-1

JIT-AN INTRODUCTION: Speed of JIT movement, the new production system research association of Japan, some definitions of JIT, core Japanese practices of JIT, enabling JIT to occur, basic element of JIT, benefits of JIT.

MODERN PRODUCTION SYSTEM: Key feature of Toyota's production system, basic framework of Toyota production system.

KANBAN SYSTEM – other types of kanban's, kanban rules, determining the number of kanban's in Toyota production system.

Module-2

PRODUCTION SMOOTHING IN TOYOTA PRODUCTION SYSTEM: production planning, production smoothing, adaptability to demand fluctuations, sequencing method for the mixed model assembly line to realize smoothed production. EDP system for support of the Toyota Production system.

GLOBAL IMPLEMENTATION OF JIT: JIT in automotive industry, JIT in electronics, computer, telecommunication and instrumentation, JIT in process type industry, JIT in seasonal demand industry, other manufacturing industries, conclusion**.**

Module-3

JIT IMPLEMENTATION SURVEYS: JIT implementation in US manufacturing firms-analysis of survey results, just in time manufacturing industries, just in time production in West Germany, just in time production in Hong Kong electronics indu8stry, conclusion.

DESIGN, DEVELOPMENT AND MANAGEMENT OF JIT MANUFACTURING SYSTEMS: plant configurations and flow analysis for JIT manufacturing, comparison of JIT's "demand pull" system with conventional "push type" planning and control systems, quality management system for JIT, product design for JIT human resource management in JIT, flexible workforce system at Toyota.

Module-4

SUPPLY MANAGEMENT FOR JIT: JIT purchasing-the Japanese way, some studies in JIT purchasing, experience of implementation organizations, surveys of JIT purchasing, buyer-seller relationship in JIT purchasing, Quality certification of suppliers in JIT purchasing, some problems in implementation of JIT purchasing, reduction freight costs in JIT purchasing, monitoring supplier performance for JIT purchasing, audit in JIT purchasing, implementation of JIT to international sourcing.

Module-5

FRAMEWORK FOR IMPLEMENTATION OF JIT: Implementation risk, risks Due to inappropriate understanding of JIT, risks due to technical, operational and people problems, risks associated with kanban system, some important activities to be performed during implementation, steps in implementation, a project work to approach to implementation, conclusion.

Course Outcomes:

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Just In Time Manufacturing	M.G. Korgaonker	Macmillan India Ltd.-	1992
2	Japanese Manufacturing Techniques	Richard J. Schonberger	The Free Press – Macmillan Pub. Co., Inc. New York	1988

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SEMESTER - VII

OPEN ELECTIVE - B

PROJECT MANAGEMENT

Course Code	**18IP751**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Course Learning Objectives Missing

Module-1

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles Project Selection and Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.

Module-2

Planning Projects: Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organisation, coding the WBS for the information system. Scheduling Projects: Purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt chart.

Module-3

Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plant, project team composition issues, Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control. Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kick off: Development of quality concepts, project quality management plan, project quality tools, kick off project, baseline and communicate project management plan, using Microsoft Project for project baselines.

Module-4

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management. Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure.

Module-5

Network Analysis : Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method (CPM) to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

Course Outcomes: At the end of the course the student will be able to:

- Understand the selection, prioritization and initiation of individual projects and strategic role of project management.
- Understand the work breakdown structure by integrating it with organization.
- Understand the scheduling and uncertainty in projects.
- Students will be able to understand risk management planning using project quality tools.
- Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects.
- Determine project progress and results through balanced scorecard approach
- Draw the network diagram to calculate the duration of the project and reduce it using crashing

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Project Management	Timothy J Kloppenborg	Cengage Learning,	Edition 2009.

2	Project Management, A systems approach to planning scheduling and controlling	Harold kerzner	CBS publication	
3	Project Management	S Choudhury,	McGraw Hill Education (India) Pvt. Ltd. New Delhi	2016
Reference Books				
4	Project Management	Pennington Lawrence	McGraw hill	
5	Project Management	A Moder Joseph and Phillips	New Yark Van Nostrand, Reinhold	
6	Project Management	Bhavesh M. Patal	Vikas publishing House,	

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SEMESTER - VII

OPEN ELECTIVE - B

AUTOMOTIVE ENGINEERING

Course Code	**18IP752**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- The layout and arrangement of principal parts of an automobile
- To learn fuel supply system ,cooling and lubrication system in IC engine
- To know the Injection system and its advancements
- The working of transmission and brake systems
- To know the automobile emissions and its effects on environment

Module-1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams. M ixture requirements in S.I engine. Simple Carburettors and its limitations. Theories of combustion process in S.I. engines. Normal and Abnormal combustion, Cetane and Octane numbers

Module-2

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, Alternative fuels, , Types of carburettors, C.D.& C.C. carburettors, Multi point and Single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System, Multi-port fuel injection system.

COOLING AND LUBRICATION: Cooling requirements, Types of cooling- Thermo siphon system, Forced circulation water cooling system, Water pump, Radiator, Significance of lubrication, Splash and Forced feed system.

Module-3

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system. Battery, Purpose, Working principle of Lead acid battery, Methods of battery charging, determination of polarity of leads, dry charged battery, battery maintenance. Principle and operation of dynamo.

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

Module-4

TRANSMISSION SYSTEMS: Clutch-Purpose and function, Single plate clutch, multiplate clutch gear boxes-manual and automatic, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Purpose and function ,Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system.

Module-5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

Course Outcomes: At the end of the course the student will be able to:

- To identify the different parts of an automobile and it's working
- To understand the working of transmission and braking systems
- To comprehend the working of steering and suspension systems
- To learn various types of fuels and injection systems
- To know the cause of automobile emissions, its effects on environment and methods to reduce the emissions.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Fluid Power with applications	Anthony Esposito	Pearson edition	2000
2	Oil Hydraulics	Majumdar S.R.	Tata Mc G Raw Hill	2002
3	Pneumatic systems - Principles and Maintenance”	Majumdar S.R.	Tata Mc G Raw Hill	2005
Reference Books				
4	Industrial Hydraulics	John Pippenger, Tyler Hicks	McGraw Hill International Edition	1980
5	Hydraulics and pneumatics	Andrew Par,	Jaico Publishing House,	2005
6	Hydraulic Control Systems	Herbert E. Merritt,	John Wiley and Sons, Inc	
7	Introduction to Fluid power	Thomson	PrentcieHaIl,	2004

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SEMESTER - VII

OPEN ELECTIVE - B

ENTERPRISE RESOURCE PLANNING

Course Code	**18IP753**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Course Learning Objectives Missing

Module-1

INTRODUCTION TO ERP: Introduction, Evolution of ERP, What is ERP, Reasons for the growth of the ERP market, The advantages of ERP, Why do Man ERP Implementations Fail? Why are ERP packages being used now?

ENTERPRISE – AN OVERVIEW: Introduction, Integrated Management Information, Business modelling, Integrated Data Model

Module-2

ERP AND RELATED TECHNOLOGIES: Introduction, Business Process Reengineering, Management Information System, Decision Support System, Executive Information Systems, Data Warehousing, Data Mining, On-line Analytical Processing, Supply Chain Management

ERP- MANUFACTURING PERSPECTIVE: Introduction, ERP. CAD/CAM, Materials Requirements Planning, Bill of Material, Closed Loop MRP. Manufacturing Resource
Planning, Distribution Requirements Planning

Module-3

KANBAN: JIT and Kanban, Product Data Management, Benefits of PDM, Make-to-order, and Make-to Stock, Assemble to order, Engineer to order, Configure-to order.

ERP MODULES: Introduction, Finance, Plant Maintenance, Quality Management, Materials Management

Module-4

BENEFITS OF ERP: Introduction, Reduction of Lead time, On-time shipment, Reduction in Cycle Time, Improved Resource Utilisation, Better Customer Satisfaction, Improved Suppler Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Decision – making capability.

ERP PACKAGES: Overview of ERP Software Introduction, SAP AG, Baan Company, Oracle Corporation, PeopleSoft, JD Edwards World Solutions Company, System Software Associates, Inc. QAD

Module-5

ERP Implementation Life Cycle: Pre-Evaluations Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation of Team Training, Testing, Going Live, end user Training, Post Implementation

VENDOR, CONSULTANTS AND USERS: Introduction, In-house implementation – Pros and Cons, Vendors, Consultants, End-users.

ERP- Case studies

Course Outcomes:

1. Make use of Enterprise software, and its role in integrating business functions
2. Analyze the strategic options for ERP identification and adoption. L
3. Design the ERP implementation strategies.
4. Create reengineered business processes for successful ERP implementation.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Enterprise Resource Planning	Alexis Leon	Tata McGraw Hill Publishing Company Ltd	1999
2	Enterprise Resource Planning Concept and Practice	Vinod Kumar Garg and Venkitakrishnan	Prentice Hall, India	2nd Edition.
Reference Books				

3	Manufacturing Planning & Controls	Thomas Volloman, et,al.		

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SEMESTER - VII

SOFTWARE APPLICATIONS LAB

Course Code	**18IPL76**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Sl. No.	Exercises
	PART-A
1	Regression and Correlation analysis using any of the statistical packages.
2	Development of simple MIS application programs for use in : (i) Library, (ii) Bank, (iii) Business shop, and (iv) Hospital
	PART-B
1	Use of software package to solve Operation Research (LPP) problems.
2	Plotting Quality Control chart using Software Packages. Plotting appropriate charts and diagrams relevant to various industrial Applications

Reference Book: Lab manual prepared by the Department/Institution.
Suggested Software Packages: For MIS: Oracle / MS SQL Server (back-end) VB6.0 / Developer2000 (front-end tools)
Statistical Package like: SPSS, or Minitab, or SAS, or Systat, or MATLAB, or Statistica, etc.
OR Packages: TORA, or LINDO, or KETRON, or ABACUS, etc.

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.'
3. Students can pick one experiment each from the questions lot prepared by the examiners from PARTS 'A' and 'B'
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
5. Scheme of Examination: exercises from Parts 'A' and ' B' = 80 Marks; Viva-voce =20 Marks.

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SEMESTER - VII

CNC AND ROBOTICS LAB

Course Code	**18IPL77**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

Sl. No.	Experiments
	PART - A
1	Study of functions assigned to Alphabets and Symbols. G and M codes, grouping of codes, Assigned and Unassigned, Model and Non Model codes.
2	Writing the program for Contour Milling - 4 exercises
3	Writing the program using Canned Cycles, Subroutine Programs for Drilling, Reaming and Thread Cutting - 4 exercises
4	Introductive concept of loop in loop program - 2 exercises.
	PART - B
1	Writing CNC program for Lathe - 2 exercises.
2	Exercises on Robots (only demonstration) Study of a General Configuration of a Robot. b. Study of Programming methods c. Study of Overview of Robot languages.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
5. Scheme of Examination: exercises from Parts ' A' and 'B' = 80 Marks; Viva-voce =20 Marks

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SEMESTER -VII

PROJECT WORK PHASE - I

Course Code	**18IPP78**	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	--
Credits	01	Exam Hours/Batch	--

Course Learning Objectives:

- To support independent learning and innovative attitude
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - I: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: At the end of the course the student will be able to:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Project Work Phase - 1:

(i)Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded

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SEMESTER -VIII

SUPPLY CHAIN MANAGEMENT

Course Code	**18IP81**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Course Learning Objectives Missing

Module-1

BUILDING A STRATEGIC FRAME WORK TO ANALYSE SUPPLY CHAINS: Supply chain stages and decision phase, process view of a supply chain. Supply chain flows.
Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit, Case discussions.

DESIGNING THE SUPPLY CHAIN NETWORK: Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

Module-2

FACILITY LOCATION AND NETWORK DESIGN: Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision trees. Analytical problems.

PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN: Review of inventory concepts., Concepts of Safety Inventory, Concept of Aggregation of Inventory, Concept of product availability.

Module-3

SOURCING, TRANSPORTATION AND PRICING PRODUCTS: Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.
Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role of Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

Module-4

COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN: Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve coordination, Building strategic partnerships.
The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of e-business in a supply chain, The e-business framework, e-business in practice. Case discussion.

Module-5

EMERGING CONCEPTS: Reverse Logistics, Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

Course Outcomes: At the end of the course the student will be able to:

- Recall the elements involved in strategic frame work and analysis of supply chains.
- Demonstrate the elements involved in the design of supply chain networks
- Demonstrate the facilities location for designing the supply chain network
- Evaluate the inventories for supply chains.
- Identify emerging concepts for supply chain networks

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year

Textbook/s				
1	Supply Chain Management – Strategy, Planning &	Sunil Chopra & Peter Meindl	Pearson Education Asia	ISBN: 81-7808-272-1. – 2001.
2	Supply Chain and Logistics Management	UpendraKachuru		
Reference Books				
3	Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems	Robert B Handfield, Ernest L Nichols,	Jr. - Pearson Education Inc	ISBN: 81-297-0113-8. -2002
4	Modelling the Supply Chain	Jeremy F Shapiro, Duxbury	Thomson Learning	ISBN 0-534-37363. -2002
5	Designing & Managing the Supply Chain	David Simchi Levi, Philip Kaminsky& Edith Simchi Levi	McGraw Hill	

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ADVANCED JOINING PROCESS AND NDT

Course Code	**18IP821**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To know the different types of welding and describe welding and cladding of dissimilar metals
- To distinguish the weldability of metals
- To identify the welding design principles and compute welding design parameters
- To illustrate the symbols used in welding practice and identify the adhesive bonding applications
- To Identify and use the welding inspection techniques and standards

Module-1

Types of Welding: Forge welding, Electro Slag Welding, Electron Beam Welding, Plasma arc Welding, Laser Beam Welding, Explosion Welding, Diffusion Welding, Ultrasonic Welding, Friction welding.

Welding and Cladding of Dissimilar Materials: Overlaying and surfacing, different methods and applications, thermal –Spray coating or metalizing.

Module-2

Weldability of Metals: like stainless steel, Cast iron, Copper, and Aluminium.
Advanced soldering and brazing processes-different types. Welding of plastics- different methods.

Module-3

Welding design: Basic principles of sound welding design, welding joint design, welding positions, Allowable strength of welds under steady loads, allowable fatigue strength of welds, Design of welds subjected to combined stresses, Numerical examples.

Module-4

Welding Symbols: Need for representing the welds, Basic weld symbols, location of weld, supplementary symbols, dimensions of weld, examples.
Adhesive Bonding: Adhesive materials and properties, non-structural and special adhesives, surface preparation and joint design considerations**.**

Module-5

Inspection of Welds: ASTM standards for testing weldments, Destructive techniques like Tensile, Bend, Nick break, Impact and Hardness. Non Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, Dye penetrant.

Course Outcomes: At the end of the course the student will be able to:

- Explain the importance of grain size control, methods to avoid distortion and residual stresses; also know the techniques of surfacing and cladding of surfaces.
- Interpret and understand the advantages and limitations of different advanced welding process knowing fully the characteristic features, this
- Identify research topics in the area of welding and related processes.
- Explain the weld ability of engineering materials including plastics and the advanced soldering and brazing processes.
- Design welds subjected to for various loading conditions.
- Explain the symbols used to represent the welds: also be able to explain the methods of adhesive bonding of materials
- Inspect the welds in accordance with ASTM standards employing both destructive and non-destructive methods.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Welding Technology	O.P. Khanna	DhanpatRai Publication	2008
2	Welding and welding Technology	Richard Little	Tata McGraw hill	2005
Reference Books				

3	Welding Engineering Handbook	A.W.S.		Ninth Edition
4	Advanced Welding processes	G. Nikolaev and N. Olshansky	MIR Publications	1977
5	ASM handbook on welding, brazing and soldering			Vol 6, 2005.

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SEMESTER -VIII

FACILITY PLANNING AND DESIGN

Course Code	**18IP822**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To know the importance of location, layouts and material handling
- To know and distinguish between different approaches to layout and draw activity relationship chart
- To compute space requirement and demonstrate skills in area allocation and construct the layout.
- To examine the quantitative approaches to facility planning and identify the different models.
- To know the different computerized techniques and model appropriate design.

Module-1

Plant Location: Factors influencing plant location, theories of plant location, plant layout objectives of plant layout, principles of plant layout, types of plant layout, their merits and demerits, facilities design function: objectives. Simple exercises on layouts.
Introduction to Material Handling: Objectives and principles of material handling, unit load concept, Basic handling equipment types, Common material handling equipments

Module-2

Plant Design: Layout procedure, study of some approaches (Immer, Nadler, Muther, Apple James and Reed's approach), systematic layout planning, the activity relationship chart, Constructing the activity relationship chart, Activity relationship diagram.

Module-3

Space Determination and Area Allocation: Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions, establishing total space requirement, area allocation factors to be considered, expansion, flexibility, aisles column, area allocation procedure, the plot plan.
Construction of the Layout: Methods of constructing the layout, evaluation of layout, efficiency indices, presenting layout to management.

Module-4

Quantitative approaches to facilities planning: Deterministic models, single and multi facility models, Conventional layout model: Block stacking, location allocation models,
Layout Models: Warehouse layout models, waiting line models, Storage models.

Module-5

Computerized Layout Planning: Computerized relative allocation of facility techniques (CRAFT), Plant layout Evaluation Techniques (PLANET), Computerized Relationship Layout Planning (CORELAP), Comparison of computerized layout techniques.

Course Outcomes: At the end of the course the student will be able to:

- Identify the planning strategies for implementation, evaluation and maintaining the facility.
- Arrive at suitable layout for given situations having understand different approaches.
- Demonstrate the Space determination and area allocation procedure, construction of the layout.
- Analyze the quantitative methods and models to determine for the plant location. Explain the warehouse and waiting line models.
- Demonstrates the ideas on various types of layout and evaluation techniques using computers.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Plant layout and material handling	James M. Apple	John, Wiley and sons	3rd edition, 1991
2	Facility layout and location	Françoise, R.L. and White, J.A	McGraw Hill	2nd edition, 1994.
Reference Books				
3	Practical layout	Muther Richard	McGraw Hill	1956

4	Plant layout design	James.M Moore, Mac Miller		1962
5	Facilities design	SundereshHeragu	PWS publishing company	ISBN-0-534-95183, August 2008
6	Facilities planning	Tompkins white	wiley India Pvt ltd	3rd edition.
7	Facility Layout and Location	Richard L Francies	PHI learning Pvt. Ltd	2nd Edition

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AUTOMATION IN MANUFACTURING

Course Code	**18IP823**	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concepts of automation in manufacturing systems
- To impart the knowledge of a line balancing and assembly systems
- To explore the idea of robotics and understand the computerized manufacturing planning
- To gain the knowledge of automated inspection and shop floor control
- To understand the concepts of additive manufacturing and latest trends in manufacturing

Module-1

Introduction: Production system facilities, Manufacturing support systems, Automation in production systems, Automation principles &strategies

Manufacturing Operations: Manufacturing operations, Product/production relationship, Production concepts and Mathematical models & costs of manufacturing operations. Problems on mathematical models

Module-2

Line Balancing: Methods of line balancing, Numerical problems on largest candidate rule, Kilbridge's and Wester's method, and ranked positional weights method, computerized line balancing methods.

Automated Assembly System: Design for automated assembly, types of automated assembly system, Parts feeding devices, Analysis of single and multi station assembly machines.

Module-3

Computerized Manufacture Planning and AGVS: Computer aided process planning (CAPP), Retrieval and Generative systems, and benefits of CAPP. Material requirement planning, Inputs to MRP system, working of MRP, Outputs and benefits. Automated Guided Vehicles System: Applications, Guidance and routing,

Industrial Robotics: Definition, Robot anatomy, Joints and links, Robot configurations, Robot control systems, Accuracy and repeatability, End effectors, Sensors in robotics. Industrial robot applications: Material handling, Processing, assembly and inspection.

Module-4

Inspection Technologies: Automated inspection, coordinate measuring machines construction, Operation &programming, Software, application &benefits, Flexible inspection system, Inspection probes on machine tools, Machine vision, Optical inspection techniques & Non-contact Non-optical inspection technologies.

Shop Floor Control and Automatic Identification Techniques: Shop floor control, Factory data collection system, Automatic identification methods, Bar code technology, Automatic data collection systems. An Introduction to QR Code Technology

Module-5

Additive Manufacturing Systems: Basic principles of additive manufacturing, Slicing CAD models for AM, Advantages and limitations of AM technologies, Recent trends in manufacturing, Hybrid manufacturing.

Future of Automated Factory: Trends in manufacturing, the future automated factory, Human workers in future automated factory, Social impact.

Course Outcomes: At the end of the course the student will be able to:

- Explain the basics of productions, automation system and manufacturing operations. Solve the simple problems on mathematical model.
- Analyze and solve problems on line balancing
- Explain CAPP and MRP system and analyze the AGVS
- Understand the inspection technologies and shop floor control
- Explain the modern trends in additive manufacturing and automated factory

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Automation, Production Systems and Computer-Integrated Manufacturing	Mikell PGroover	PHI Learning	3rd Edition, 2009
2	CAD / CAM Principles and	P N Rao,	Tata McGraw-	3rd Edition, 2015

3	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing,	Ian Gibson, David W. Rosen, BrentStucker		2nd Ed. (2015),
4	Understanding Additive	Andreas Gebhardt	Hanser Publishers	2011
Reference Books				
5	Systems Approach to Computer-Integrated Design and	Dr.Nanua Singh,	Wiley	1996
6	CAD/CAM/CIM	P. Radhakrishnan, S. Subramanyan, U.Raju	New Age International	Revised Third Edition 2007

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SEMESTER -VIII

PROJECT WORK PHASE -II

Course Code	**18IPP83**	CIE Marks	40
Contact Hours/Week	02	SEE Marks	60
Credits	08	Exam Hours/Batch	03

Course Learning Objectives:

- To support independent learning and innovative attitude
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: At the end of the course the student will be able to:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Project Work Phase - 2:

(i)Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Semester End Examination

SEE marks for the project (60 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) as per the University norms by the examiners appointed VTU.

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SEMESTER -VIII

TECHNICAL SEMINAR

Course Code	**18IPS84**	CIE Marks	100
Contact Hours/Week	02	SEE Marks	--
Credits	01	Exam Hours	--

Course Learning Objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.

- Carryout literature survey, organize the seminar content in a systematic manner.
- Prepare the report with own sentences, avoiding cut and paste act.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the

Course Outcomes: At the end of the course the student will be able to:

- Attain, use and develop knowledge in the field of engineering and other disciplines through independent learning and collaborative study.
- Identify, understand and discuss current, real-time issues.
- Improve oral and written communication skills.
- Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks : Presentation skill:25 marks :Question and Answer:25 marks.