

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI**

**BE/B.Tech 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
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)
(Effective from the academic year 2018 – 19)

III SEMESTER												
Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration 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	18IM32	Mechanics of Materials		3	2	--	03	40	60	100	4
3	PCC	18IM33	Fluid Mechanics		3	0	--	03	40	60	100	3
4	PCC	18IM34	Basic Thermodynamics		3	0	--	03	40	60	100	3
5	PCC	18IM35	Mechanical Measurements & Metrology		3	0	--	03	40	60	100	3
6	PCC	18IM36	Manufacturing Process		3	0	--	03	40	60	100	3
7	PCC	18IML37	Foundry and Forging Lab /Machine Shop		--	2	2	03	40	60	100	2
8	PCC	18IML38	Metallography and Material Testing Lab /Metrology and Measurements lab		--	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	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
TOTAL					17	08	04	24	420	480	900	24
					OR	OR	OR	OR	OR			
					18	10		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
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(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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IVSEMESTER												
Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT41	Complex Analysis, Probability and Statistical	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18IM42	Computer Aided Machine Drawing		3	2	--	03	40	60	100	4
3	PCC	18IM43	Kinematics of Machines		3	0	--	03	40	60	100	3
4	PCC	18IM44	Statistics for Engineers		3	0	--	03	40	60	100	3
5	PCC	18IM45	Material Science and Metallurgy		3	0	--	03	40	60	100	3
6	PCC	18IM46	Work Study & Ergonomics		3	0	--	03	40	60	100	3
7	PCC	18IML47	Foundry and Forging Lab /Machine Shop		--	2	2	03	40	60	100	2
8	PCC	18IML48	Metallography and Material Testing Lab /Metrology and Measurements lab		--	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)									
		ORp										
		18CPC49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
TOTAL					17	08	04	24	420	480	900	24
					OR	OR	OR	OR	OR	OR		
					18	10		26	360	540		
Examination is by objective type questions												
Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.												
18KVK39/49Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39/49 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	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												
Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination			Credits	
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks		Total Marks
					L	T	P					
1	PCC	18IM51	Management& Entrepreneurship		2	2	--	03	40	60	100	3
2	PCC	18IM52	Operation Research		3	2	--	03	40	60	100	4
3	PCC	18IM53	Quality Assurance& Reliability		3	2	--	03	40	60	100	4
4	PCC	18IM54	Engineering Economy		3	--	--	03	40	60	100	3
5	PCC	18IM55	Facility Planning & Design		3	--	--	03	40	60	100	3
6	PCC	18IM56	Materials Management		3	--	--	03	40	60	100	3
7	PCC	18IML57	Mechanical Lab		--	2	2	03	40	60	100	2
8	PCC	18IML58	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					18	10	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												
Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18IM61	Simulation Modelling & Analysis		3	2	--	03	40	60	100	4
2	PCC	18IM62	Operation Management		3	2	--	03	40	60	100	4
3	PCC	18IM63	Data Analytics for Engineers		3	2	--	03	40	60	100	4
4	PEC	18IM64X	Professional Elective -I		3	--	--	03	40	60	100	3
5	OEC	18IM65X	Open Elective -A		3	--	--	03	40	60	100	3
6	PCC	18IML66	Data Analytics Lab		--	2	2	03	40	60	100	2
7	PCC	18IML67	Quality engineering lab		--	2	2	03	40	60	100	2
8	MP	18IMMP68	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 VII and VIII semesters.								
TOTAL					15	10	06	24	320	480	800	24
Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.												
Professional Elective -I												
Course code under 18IM64X			Course Title									
18IM641			Financial Accounting and Costing									
18IM642			Human Resource Management									
18IM643			Management Information System									
18IM644			Data Base Management System									
Open Elective -A												
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 18IM65X).												
Selection of an open elective shall not be allowed if,												
<ul style="list-style-type: none"> • 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 belong 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												
Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination			Credits	
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks		Total Marks
					L	T	P					
1	PCC	18IM71	Enterprise Resource & Planning		3	--	--	03	40	60	100	3
2	PCC	18IM72	Value Engineering		3	--	--	03	40	60	100	3
3	PEC	18IM73X	Professional Elective - 2		3	--	--	03	40	60	100	3
4	PEC	18IM74X	Professional Elective - 3		3	--	--	03	40	60	100	3
5	OEC	18IM75X	Open Elective -B		3	--	--	03	40	60	100	3
6	PCC	18IML76	Simulation Lab		--	2	2	03	40	60	100	2
7	PCC	18IML77	Enterprise Resource Planning Lab		--	2	2	03	40	60	100	2
8	Project	18IMP78	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					15	04	06	21	380	420	800	20
Note: PCC: Professional core, PEC: Professional Elective.												
Professional Elective - 2												
Course code under 18IM73X		Course Title										
18IM731		Project Management										
18IM732		Marketing Management										
18IM733		Strategic Management										
18IM734		Software Engineering and Management										
Professional Electives - 3												
Course code under 18IM74X		Course Title										
18IM741		Organizational Behaviour										
18IM742		Design of Experiments										
18IM743		World class Manufacturing										
18IM744		Maintenance and safety Engineering										
Open Elective -B												
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 18IM75X).												
Selection of an open elective shall not be allowed if,												
<ul style="list-style-type: none"> • 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 multidisciplinary 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 project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), 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 (covering Literature Survey, Problem identification, Objectives and Methodology), 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.												
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												
Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18IM81	Supply Chain Management		3	--	--	03	40	60	100	3
2	PEC	18IM82X	Professional Elective - 4		3	--	--	03	40	60	100	3
3	Project	18IMP83	Project Work Phase - 2		--	--	2	03	40	60	100	8
4	Seminar	18IMS84	Technical Seminar		--	--	2	03	100	--	100	1
5	Internship	18IMI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
TOTAL					06	--	04	15	260	240	500	18
Note: PCC: Professional Core, PEC: Professional Elective.												
Professional Electives - 4												
Course code under 18IM82X		Course Title										
18IM821		Automation in Manufacturing										
18IM822		Lean Manufacturing										
18IM823		Total Quality Management										
18IM824		Financial Management										
Project Work												
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.												
SEE for Project Work Phase - 2:												
(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.												
(ii) Interdisciplinary: Contribution to the 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: Those, who have not pursued /completed the internship, shall be declared as fail and 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 8th semester. 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 in INDUSTRIAL ENGINEERING & MANAGEMENT (IM)					
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)					
SEMESTER - VI					
OPEN ELECTIVE - A					
Course Code	18IM65X		CIE Marks	40	
Teaching Hours/Week (L:T:P)	(3:0:0)		SEE Marks	60	
Credits	03		Exam Hours	03	
Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (For syllabus, please refer to the concerned Programme syllabus book or VTU website vtu.ac.in may be visited.).					
Selection of an open elective shall not be allowed if,					
<ul style="list-style-type: none"> • 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.					
SINO	Board and the Department offering the Electives		Course		Course Title
			SI No	code under 18IM65X	
			1	18IM651	Value Engineering
			2	18IM652	Data Analytics for Engineers
			3	18IM653	Engineering Economy

B.E in INDUSTRIAL ENGINEERING & MANAGEMENT (IM)					
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)					
SEMESTER - VII					
OPEN ELECTIVE - B					
Course Code	18IM75X		CIE Marks	40	
Teaching Hours/Week (L:T:P)	(3:0:0)		SEE Marks	60	
Credits	03		Exam Hours	03	
Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (For syllabus, please refer to the concerned Programme syllabus book or VTU website vtu.ac.in may be visited.).					
Selection of an open elective shall not be allowed if,					
<ul style="list-style-type: none"> • 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.					
SINO	Board and the Department offering the Electives		Course		Course Title
			SI No	code under 18IM75X	
			1	18IM751	Human Resources Management
			2	18IM752	Organizational Behaviour
			3	18IM753	Supply Chain Management



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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	3	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • 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			
<p>Laplace Transform: Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.</p> <p>Inverse Laplace Transform: Definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.</p>			
Module-2			
<p>Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.</p>			
Module-3			
<p>Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.</p> <p>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 and applications to solve difference equations.</p>			
Module-4			
<p>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. Runge -Kutta method of fourth order, Milne's and Adam-Bash forth predictor and corrector method (No derivations of formulae)-Problems.</p>			
Module-5			
<p>Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).</p> <p>Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.</p>			
Course Outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • 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 externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44 th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3 rd Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6 th Edition, 1995
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4 th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11 th Edition, 2010
4	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	6 th Edition, 2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018
Web links and Video Lectures:				
<ol style="list-style-type: none"> 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 Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - III			
Mechanics of Materials			
Course Code	18IM32	CIE Marks	40
Number of Lecture Hours/Week (L:T:P) (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives: To provide the students with			
<ul style="list-style-type: none"> • Classify the stresses and define elastic properties of materials and compute stress and strain intensities caused by applied loads in simple and compound sections and temperature changes. • Derive the equations for principal stress and maximum in-plane shear stress and calculate their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle. • Determine the shear force, bending moment and draw shear force and bending moment diagrams, describe behavior of beams under lateral loads. • Explain the structural behavior of members subjected to torque, Calculate stress induced in shafts subjected to bending and torsion. • Understand the concept of stability and derive crippling loads for columns. • Understand the concept of deflection and slop in beams 			
Module-1			
Simple Stress and Strain: Introduction, Stress, strain and types. Tensile test on a mild steel and cast iron specimens: Stress-Strain relation, Hooke's Law and Poisson's ratio for cast iron and non-ferrous (Al) materials. Extension / Shortening of bars of: Uniform, varying in steps and 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, formula for elastic constants (No derivation for relationship between elastic constants), Temperature stresses (excluding compound bars). Simple numerical problems on tensile test and determining stress, strain and 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 - Lamé'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 formulas (no derivation) for axially loaded elastic long columns, Limitations of Euler's theory, Rankine's formula			
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, method of solution: by Double integration, deducing the constants of integration with boundary conditions. Table of deflections and slopes for typical cases			

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

- Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations.
- Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal loads
- Determine plane stress, principal stress, maximum shear stress and their orientations using Mohr's circle
- Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders
- Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples
- Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL
- Determine the dimensions of shafts based on torsional strength, rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory
- Understand the concept of design concentric Pt of thin and thick cylinders
- Determination of deflection and slope for different boundary conditions by double integration method

Text Books:

1. James M Gere, Barry J Goodno, Strength of Materials, Indian Edition, Cengage Learning, 2009.
2. R Subramanian, Strength of Materials, Oxford, 2005.

Reference Books:

1. S S Rattan, Strength of Materials, Second Edition, McGraw Hill, 2011.
2. Strength of Materials by Bhavi Katti
2. Ferdinand Beer and Russell Johnston, Mechanics of materials, Tata McGraw Hill, 2003.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - III			
Fluid Mechanics			
Course Code	18IM33	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives: To provide the students with			
<ul style="list-style-type: none"> • 1. The fundamentals of fluid mechanics, fluids and its properties. • 2. An understanding of fluid statistics and hence the usage of Manometers, forces on submerged bodies. • 3. Study of Buoyancy, metacenter, continuity equation and different functions • 4. Application of Bernoulli's equation to measure energy levels • 5. Using different fluid equipment's to calculate fluid flow and using Dimensional analysis to solve flow problems. • 6. Understanding the phenomenon of losses during flow in pipes. • 7. Study of Laminar flow and the viscous effects. • 8. Evaluating the various parameters connected to flow around immersed bodies. 			
Module-1			
Properties of Fluids: Introduction, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation			
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.			
Module-2			
Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.			
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 acceleration			
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, orificemeter, pitot-tube, vertical orifice, VNotch and rectangular notches.			
Module-4			
Flow through pipes: Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes			
Module-5			
Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers,			
Course Outcomes: After the completion of the course, a student will			
<ol style="list-style-type: none"> 1. Examine the fundamental of fluid mechanics and fluids and apply the basic equations to find the force on submerged surfaces. 2. Calculate using known formula to calculate the center of buoyancy and find the velocity and acceleration. 3. Calculate various flow parameters using fluid flow meters and using dimension analysis to predict flow phenomena. 4. Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities & pressures. Calculate frictional losses through pipes. 			
Text Books:			
<ol style="list-style-type: none"> 1. Fluid Mechanics and Fluid Power Engineering, Kumar.D.S, Kataria and Sons., 2004. 2. Fluid Mechancis by Dr. Bansal, R.K.Lakshmi Publications, 2004. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Fluid Mechanics and hydraulics, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997. 2. Fluid Mechanics (SI Units), Yunus A. Cingel John M.Oimbala. Tata MaGrawHill, 2006. 3. Fluid Mechanics by John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006 			

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
BASIC THERMODYNAMICS			
Course Code	18IM34	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To prepare the students to understand the fundamental concepts, terminologies, scope and application of thermodynamics. The thermodynamic path for quasi- equilibrium processes, the graphical representation of processes. Calculation of heat and work for different processes. • Understand the joule's experiment, and equivalent heating effect produced by work. First law application to steady flow and unsteady flow system. Second law of thermodynamics, and entropy. • Understand the properties of pure substance, phase change terminology, methods of finding dryness fraction, and to know the systematic procedure for reading property tables. • To know the mathematical interrelations of non-measurable thermodynamic properties, with the aid of these relations, the changes in these properties can be computed. 			
Module-1			
<p>Fundamental Concepts & Definition: 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 equilibrium: definition. Mechanical equilibrium, diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics. Temperature: concepts, scales, fixed points and measurements. (Liquid in glass capillary, Electrical Resistance Thermometer, Thermocouples, Constant Volume Gas Thermometer, and constant Pressure gas thermometer only are included). Numerical problems on temperature scale.</p> <p>Heat and work: Heat, Characteristics of heat, Sign Convention and units for heat, Work transfer, Thermodynamic definition of work, Characteristic of work, sign convention and units for work. Classification of work, Mechanical form of work, Moving boundary work or Displacement work, Prove work is a path function, expression of Displacement work for Different Quasi- static processes by representing on a p-V diagrams. Numerical problems. (work done in stretching a wire, work associated with stretching of a liquid film, electric work due to current flow, Magnetic work due change in magnetization of a substance explanation and problems are not included).</p>			
Module-2			
<p>First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the first law of thermodynamics, extension of the First law to 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 and numerical problems.</p> <p>APPLICATION OF FIRST LAW OF THERMODYNAMICS: Extension of the first law to control volume: Steady state- steady flow energy equation, important applications, and numerical problems steady flow systems. (Analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer, and numerical problems of unsteady processes is not included).</p>			
Module-3			
<p>Second Law of Thermodynamics: Limitations of First law, Thermal reservoir, Heat engine, Direct heat engine, performance of Direct heat engine, Kelvin- Planck statement of second law, Reversed heat engine, Performance of a reversed heat engine, clausius statement of second law. Equivalence of Kelvin- Planck and Clausius statements. Reversible and Irreversible cyclic processes. (Important consequences of the second law of thermodynamics, Absolute scale of temperature, Reversibility and Irreversibility as applied to Non- Cyclic Processes are not included)</p> <p>Entropy: Introduction, State and prove clausius theorem, Entropy- a property of the system, state and prove, the clausius inequality, Principle of increase of entropy, carnot cycle, and numerical problems.</p>			
Module-4			
<p>Pure Substances: Introduction, Property diagrams for simple compressible substance, T-v, p-v and p-T diagrams. Definition of Various important thermodynamic states of a pure substance, (i) Compressed liquid</p>			

state or sub-cooled liquid state, (ii) Saturated liquid state, (iii) Wet vapour state, (iv) Dry vapour or saturated vapour state, (v) Superheated vapour state, (vi) Saturated temperature or boiling point temperature, (vii) Saturated pressure or boiling pressure and (viii) critical point. Dryness fraction of a wet vapour. Steam tables, T-s and h-s Diagrams for a pure substance, p-h Diagrams for a pure substance. Determination of dryness fraction of steam in a laboratory, Separating calorimeter method, Throttling calorimeter, Combined separating-throttling calorimeter method, problems to find properties of pure substances.

Module-5

Ideal Gases and Mixture of Ideal Gases: Definition of an Ideal Gas, Mole of a Gas, Avogadro's Hypothesis, Specific heats of Ideal Gases, Changes in Internal energy, enthalpy for an ideal gas, expressions for heat and work transfer for a perfect gas undergoing various quasi-static processes, problems on ideal gases,

Mixture of Ideal gases Introduction, Definition of terms used in the analysis of mixture of gases, Dalton's law of partial pressure, Relation between Partial pressure, Partial Volume, and Mole Fraction, Gas constant and Molecular weight for the mixture in terms of mass fraction, Gas constant and Molecular Weight of the Mixture in Terms of Mole Fraction, Internal Energy, Enthalpy and Entropy of a Mixture of Gases. Problems on Mixture of Ideal Gases.

Course Outcomes:

- Explain thermodynamic system, zeroth law of thermodynamics, temperature scales and energy interaction. Determine heat and work. First and second law of thermodynamics to find energy, efficiency of heat engine and COP of refrigerator and heat pump.
- Interpret behavior of pure substances, working of throttling calorimeters to find dryness fraction, to follow the systematic procedure to use thermodynamic hand book.
- To use appropriate mathematical interrelation to evaluate the thermodynamic properties.
- To use thermodynamics in engineering practices.

Text Books:

1. Basic Engineering Thermodynamics. A. Venkatesh, Universities Press. 2008.
2. Basic and Applied Thermodynamics. P.K. Nag, 2nd. Ed., Tata McGraw Hill Pub.2002.
3. Thermal Engineering, R.K. Rajput, Laxmi Publication.
4. Basic Thermodynamics. T. R. Seetharam, Second Edition, InterlinePublishing, 2007.

Reference Books:

1. Thermodynamics. An Engineering Approach, Yunus A. Cengel, and Michael A Boles, Tata McGraw Hill publications. 2002.
2. Engineering Thermodynamics. J. B. Jones and G.A. Hawkins. John Wiley and Sons.
3. Fundamentals of Classical Thermodynamics. G. J. Van Wylen and R. E. Sonntag, Wiley Eastern.
4. An Introduction to Thermodynamics. Y.V.C. Rao, Wiley Eastern. 1993.
5. Basic Thermodynamics, B.K. Vekanna, Swati B. Wadavadagi, PHI, New Delhi. 2010

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - III			
Mechanical Measurements and Metrology			
Course Code	18IM35	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<p>Course Learning Objectives: To provide the students with</p> <ul style="list-style-type: none"> • Understand metrology and its advancements. & measuring system • Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators. • Equip with knowledge of limits, fits, tolerances and gauging. • Acquire knowledge of measurement methods with emphasis on different transducers, intermediate modifying and terminating devices. • Understand the measurement of Force, Torque, Pressure, Temperature and Strain. 			
Module-1			
<p>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.</p> <p>Measurements and measurement system: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors.</p>			
Module-2			
<p>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. Numerical problems on the design of shaft and hole pair</p> <p>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. Numerical problems.</p>			
Module-3			
<p>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, Solex comparators.</p> <p>Angular measurements: bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), and clinometers.</p> <p>Interferometer and screw thread, gear measurement: Interferometer, interferometry, 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 tooth terminology, use of gear tooth vernier caliper and micrometer.</p>			
Module-4			
<p>Sensors and Transducers:, primary and secondary transducers, transfer efficiency, electrical, mechanical, electronic transducers, advantages of each type transducers.</p> <p>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.</p>			
Module-5			
<p>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 members, Bridgeman gauge, Mc loed gauge, Pirani gauge.</p> <p>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.</p>			

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

- Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.
- Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.
- Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.
- Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators, and Zeiss Ultra Optimeter
- Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker’s microscope.
- Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method,
- Explain the measurement of pitch, concentricity, run out and involute profile
- Understand laser interferometers and Coordinate measuring machines.
- Explain measurement systems, transducers, intermediate modifying devices and terminating devices.
- Describe functioning of force, torque, pressure, strain and temperature measuring devices.

Text Books:

1. Mechanical Measurements, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Engineering Metrology, R.K. Jain, Khanna Publishers, Delhi, 2009.

Reference Books:

4. Engineering Metrology and Measurements, Bentley, Pearson Education.
5. Theory and Design for Mechanical Measurements, III edition, Richard S Figliola, Donald E Beasley, WILEY India Publishers.
6. Engineering Metrology, Gupta I.C., DhanpatRai Publications.
7. Deoblin’s Measurement system, Ernest Deoblin, Dhaneshmanick, McGraw –Hill.
8. Engineering Metrology and Measurements, N.V.Raghavendra and L. Krishnamurthy, Oxford University Press.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - III			
Manufacturing Process			
Course Code	18IM36	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Understand the types of production processes, steps involved in casting, types of patterns, pattern making, pattern allowance, cores, furnaces, advantages and limitations of casting. 2. Know the fundamentals of metal cutting like various cutting forces, tool materials, about tool life and machinability. 3. Understand the importance of emerging technologies in manufacturing field. 			
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, Classification of patterns.			
Sand Moulding : Requirement of base sand, Method used for sand moulding			
Binder & Additives: Definition, Types and characteristics.			
Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.			
Module-2			
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: No bakemoulds, CO ₂ mould, Shellmould, Investment mould.			
Metal Moulds: Pressure die casting, Slush casting.			
Module-3			
Introduction: Forging, Rolling, extrusion, Drawing, Sheet metal forming. (Operations)			
Theory of Metal Cutting: Single point cutting tool nomenclature, Mechanics of Chip Formation, Types of Chips, Merchant's circle diagram and analysis. Tool Wear and Tool failure. Effects of cutting parameters on tool life. Taylor's Tool Life equation. Problem on tool life evaluation.			
Module-4			
METAL REMOVAL OPERATIONS:			
Turning: Classification, constructional features of Turret and Capstan Lathe. Different operations on lathe and Mechanisms: Withworth's quick return motion mechanism, Crank and slotted lever mechanism.			
Milling: Classification, constructional features of Horizontal & Vertical spindle, column and knee milling machine. Mill cutter nomenclature, Different operations on Milling, Indexing (Numerical)			
Introduction: Shaping, Planning, Grinding, Broaching. (Operations)			
Module-5			
NC & CNC: Elements of NC and CNC system, role of computers in manufacturing of a product, Introduction to G-codes and M-codes.			
Rapid Prototyping: Definition of RP, RP cycle, Stereolithography, selective laser sintering, 3D Printing.			
Flexible manufacturing System: Definition, components of FMS, types of FMS, advantages and limitations of FMS.			
Course Outcomes: students should be able to			
CO1: Carry out step by step casting process to make components.			
CO2: Analyze the process of moulding and casting to make metal casting.			
CO3: Analyze the various cutting forces during metal cutting operations.			
CO4: Distinguish among various metal removal operations and use appropriate in industry.			
CO5: Investigate on tool failure.			
CO6: Appraise the advanced manufacturing technology over conventional manufacturing process.			
Text Books:			
<ol style="list-style-type: none"> 1. Manufacturing Engineering and Technology, Kalpakjian and Schmid, Prentice Hall, New Jersey, 2013 2. "Manufacturing Process-I", Dr. K. Radhakrishna, Sapna Book House, 5th Revised Edition 2009. 			

Reference Books:

1. "Process and Materials of Manufacturing", Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
2. "Manufacturing Technology", SeropeKalpakjian, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed. 2006.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - III			
FOUNDRY & FORGING LAB			
Course Code	18IML37/47	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • 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 			
Experiments:			
PART – A			
1. Testing of Moulding sand and Core sand			
Preparation of sand specimens and conduction of the following tests:			
1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.			
2 Permeability test			
3 Core hardness & Mould hardness tests.			
4 Sieve Analysis to find Grain Fineness number of Base Sand			
5 Clay content determination in Base Sand			
PART – B			
2. Foundry Practice			
Use of foundry tools and other equipments.			
Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).			
Preparation of one casting (Aluminum or cast iron-Demonstration only)			
PART – C			
3. Forging Operations :			
Calculation of length of the raw material required to do the model.			
Course Outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • 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 			
Scheme of Examination:			
One question is to be set from Part-A: 50 marks			
One question is to be set from either			
Part-B or Part-C: 30 marks			
Viva Voce: 20 Marks			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - III			
METALLOGRAPHY AND MATERIAL TESTING LAB			
Course Code	18IML38/48	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
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 heattreated 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			
1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine			
2. Torsion Test			
3. Bending Test on metallic and nonmetallic specimens.			
4. Izod and Charpy Tests on M.S, C.I Specimen.			
5. Brinell, Rockwell and Vickers's Hardness test.			
6. Fatigue Test.			
Course Outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • 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). 			
Scheme of Examination:			
ONE question from part -A: 20 Marks			
ONE question from part -B: 40 Marks			
Viva -Voice: 20 Marks Total: 80 Marks			

B. E. (Common to all Programmes) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER –II / III / IV			15
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:			
<ul style="list-style-type: none"> • ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ 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 (ಪ್ರಿನ್ಸಿಪಲ್ 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:			
<ul style="list-style-type: none"> • 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 - ಅರ್ಜಿ (ಅಡ್ಮಿಷನ್‌ಗಳ ಬಟಿಲಾಜಿಟಿಟಿಟಿ ಇಷಿಟಿಟಿಟಿಟಿಟಿ):			
ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೇ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.			
ಪಠ್ಯಪುಸ್ತಕ : ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಏಜಿಟಿಟಿಟಿಟಿಟಿ ಜಿಡಿ ಂಜಟಿಟಿಟಿಟಿಟಿಟಿಟಿ)			
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 –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:			
Chapter - 1: Vyavaharika kannada – Parichaya (Introduction to Vyavaharika Kannada).			
Chapter - 2: Kannada Aksharamale haagu uchcharane (Kannada Alpabets and Pronunciation).			
Chapter - 3: Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication).			
Chapter - 4: Kannada Grammar in Conversations (Sambhashaneyalli Kannada Vyakarana).			
Chapter - 5: Activities in Kannada.			
Course Outcomes:			
At the end of the course, the student will be able to understand Kannada and communicate in Kannada language.			
ಪರೀಕ್ಷೆಯ ವಿಧಾನ : ನಿರಂತರ ಅಂತರಿಕ ಮೌಲ್ಯಮಾಪನ - ಅಭಿಜ್ಞ (ಅಭಿಜ್ಞಾಪನಾ ಪರಿಣಾಮಾಪನಾ ಇತ್ಯಂತಿತ್ಯಂತಿ): ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೇ ಅಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.			
ಬಿಜ್ಞಾನಾಭಿಜ್ಞ (ಪಠ್ಯಪುಸ್ತಕ): ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (ಗಿರಿಜಾಪೀಠದಿಂದ ಬಿಟ್ಟು ಬಿಜ್ಞಾನಾ :ಅಭಿಜ್ಞಾ) ಸಂಪಾದಕರು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.			

B. E. Common to all Programmes			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
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			
<ul style="list-style-type: none"> • 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 Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. 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,			
CO 1: Have constitutional knowledge and legal literacy.			
CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers.			
CO 3: Understand the the cybercrimes and cyber laws for cyber safety measures.			
Question paper pattern for SEE and CIE:			
<ul style="list-style-type: none"> • 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.	Title of the Book	Name of the	Name of the
			Edition and Year

No.		Author/s	Publisher	
Textbook/s				
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:				
<ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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	43 rd Edition, 2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th 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: <ul style="list-style-type: none"> 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			
Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b$, $y = ax^b$ & $y = ax^2 + bx + c$. Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems.			
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: <ul style="list-style-type: none"> CO1: Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory. CO2: Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing. CO3: Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field. CO4: Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data. CO5: Construct joint probability distributions and demonstrate the validity of testing the hypothesis. 			
Question paper pattern: <ul style="list-style-type: none"> 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

Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition,2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44 th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3 rd Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill	6 th Edition 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4 th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11 th Edition,2010
4	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	6 th Edition, 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 Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - IV			
COMPUTER AIDED MACHINE DRAWING			
Course Code	18IM42	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To sketch the Sections of Solids, where a student can have inner details of the solids. • Analyze the pictorial views and convert into orthographic view using first angle projection. • The students are taught the importance, applications and selection of fasteners, keys, cotters and couplings etc. • To create an interest in alternative joining process. • With the thorough knowledge of part drawings of individual components, the final assembly drawing of the machine part can be hand sketched and drafted by using solid edge software. 			
PART-A			
Module-1			
<p>Section of solids: Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their base (No problems on, axis inclination, spheres and hollow solids) True shape of section.</p> <p>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.</p>			
Module-2			
<p>Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.</p> <p>Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly), simple assembly using stud bolts with nut and lock nut.</p>			
PART-B			
Module-3			
<p>Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets).</p> <p>Keys: Parallel, Taper and Feather key.</p> <p>Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.</p> <p>Couplings: Split Muff coupling and Protected type flanged coupling</p>			
PART-C			
Module-4			
<p>Assembly Drawings: (Parts drawings shall be given)</p> <ol style="list-style-type: none"> 1. Screw jack (Bottle type). 2. Plummer block (Pedestal Bearing). 3. Machine vice. 			
Course Outcomes. After the course the students will be able to			
<ul style="list-style-type: none"> • Understand sections of Solids, Sectional views, concept of Auxiliary views sketching and preparation of CAD drawing using Solid Edge software. • Students are able to understand & use the various types of Fasteners like nuts, bolts & threaded profiles of various standards (ISO, British etc.,) • Sketch & prepare CAD drawing of riveted joints / sectional views etc. & understand the functions of fabrication processes. • Sketch & prepare CAD drawing of various couplings, Cotter joint, Knuckle joint etc., • Sketch & prepare assembly (3-D view) and orthographic views of Screw Jack, Plummer Block and Machine Vice, Connecting Rod. • Implement the above skills in fabrication for the given mechanical design projects in higher semesters. Pursue higher education in the field (CAD/CAM/CAE) to become a specialist. 			
Question paper pattern:			
<ul style="list-style-type: none"> • Two questions are set from Part-A, Part-B, and Part-C. • Students has to answer one question each from Part-A, Part-B for 20 marks each and one question from Part C for 60 marks and total= 100 marks. 			
TEXT BOOKS:			
<ol style="list-style-type: none"> 1. A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum. 			

2. Machine Drawing', N. D. Bhat & V.M. Panchal.

3. Computer Aided Machine Drawing, K.R. Gopalakrishna, A.S. Ravindra,Subhas Publication-2017

REFERENCE BOOKS:

1. Machine Drawing, N. Siddeshwar, P. Kannaiyah, V. V. S. Sastri published by Tata Mc GrawHill,2006.

2. A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007.

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - IV			
KINEMATICS OF MACHINES			
Course Code	18IM43	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p>Course Learning Objectives: To enable the student to</p> <ol style="list-style-type: none"> 1. Acquire knowledge of mechanism and their inversions that are required to construct a machine with the help of different linkages. 2. Acquire knowledge of mechanism and their inversions that are required to construct a machine with the help of different linkages. 3. Find degree of freedom for various combinations of linkages. 4. Find the velocity and acceleration of mechanisms. Understand spur gear terminology, find the minimum number of tooth to transmit the motion, and also they know, how to avoid interference. 5. Understand how effectively utilize the gear train in power transmission. Draw the cam profile for different motion of the follower. 			
Module-1			
<p>Introduction: Definition, link or element, kinematic pairs, Degree of freedom, Grubler's criterion (without derivation), Problems to find degree of freedom for combination of links, Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.</p> <p>Kinematics Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double Slider crank chain</p>			
Module-2			
<p>Mechanisms: Quick return motion mechanism: Whitworth mechanism, and crank and slotted lever mechanism. Straight line motion mechanism: Peaucellier's mechanism and Robert's mechanism, Intermittent motion mechanisms- Geneva wheel mechanism and Ratchet and Pawl mechanism, Other mechanisms: Toggle mechanism. Pentograph.</p>			
Module-3			
<p>Velocity and Acceleration Analysis of Mechanism (Graphical Method) 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.</p>			
Module-4			
<p>Gears: Introduction, Classification of Gears, Gear terminology, law of gearing, Path of contact, Contact ratio, Interference in involute gears, Minimum number of teeth, Problems to find Addendum, Path of contact, Arc of contact, minimum number of teeth on each wheel to avoid interference, contact ratio only.</p> <p>Gear Trains: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, Tooth load and torque calculations in epicyclic gear trains.</p>			
Module-5			
<p>Cams: Introduction, types of cams, types of followers, terminology of cam. Motions of follower, Displacement, Velocity, and acceleration curves of one complete rotation of cam. Draw the cam profile for follower motions including SHM, Uniform velocity, uniform acceleration and retardation and cycloidal motion. Determine the maximum velocity and acceleration for above mentioned motions only for knife edge and roller follower.</p>			
<p>Course Outcomes:</p> <ul style="list-style-type: none"> • Understand the definition of terms used in kinematics of machines, working of four bar chain, single slider crank chain, and double slide crank chain, their inversions, intermittent motion and straight line motion mechanisms. Apply to construct the combination of links to get a mechanism or machine to do a required useful work. • Understand the analysis of velocity and acceleration of mechanisms using graphical method. In further vibration studies, acceleration evaluates the natural frequency of a machine to justify the safe running of a machine. • Understand the terminology and characteristics of spur gear and gear trains. Formulate and solving the gear train to evaluate speed, torque and output for create a required gear train of smaller sizes in a lesser space. • Illustrate and analyze CAM profiles with the knowledge of motions of follower. To create a cam profile for required follower motion & justify the maximum velocity and acceleration of the follower. 			
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.

Text Books:

1. Theory of Machines, Rattan. S. S, Tata Mc Graw-Hill Publishing Co Ltd, New Delhi, 3rd edition-2009.
2. Theory of Machines, Sadhu Singh, Pearson Education (Singapore) Pvt, Ltd, Indian Branch, New Delhi, 2nd Ed, 2006.

Reference Books:

1. Theory of Machines and Mechanisms, J. J. Uicker, G.R. Penock, J.E. Shigley, OXFORD 3rd Ed. 2009.
2. Mechanism and Machine theory, Ambakar, PHI

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - IV			
STATISTICS FOR ENGINEERS			
Course Code	18IM44	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Explain the concepts related to data summarization, data handling and estimation techniques for statistical processing. 2. Apply the concepts of probability, distributions and their applications to derive point and interval estimates. 3. Analyze problems using descriptive and inferential statistical processing of data. 4. Understand and apply the concept of factorial Design for optimizing the process parameters. 			
Module-1			
THE ROLE OF STATISTICS IN ENGINEERING: Statistical Thinking, Collecting data, Statistical Modelling Frame work.			
DATA SUMMARY AND PRESENTATION: Measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display.			
DISCRETE RANDOM VARIABLES AND PROBABILITY			
DISTRIBUTIONS: Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, Discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution.			
Module-2			
CONTINUOUS RANDOM VARIABLES AND PROBABILITY			
DISTRIBUTIONS: Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution.			
ESTIMATION THEORY: Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of mean, variance and proportion. Introduction to confidence intervals.			
Module-3			
STATISTICAL INFERENCE FOR A SINGLE SAMPLE: Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion.			
STATISTICAL INFERENCE FOR TWO SAMPLES: Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.			
NON-PARAMETRIC TESTS- Chi-square tests, Goodness of fit and Contingency table tests			
Module-4			
SIMPLE LINEAR REGRESSIONS AND CORRELATION: Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of regression model, Transformations to a straight line, Introduction to multiple regression (no problems), Correlation (Problems).			
Module-5			
DESIGN OF EXPERIMENTS: Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects model, the randomized complete block design, one way analysis of variance and two way analysis of variance, 22 Factorial Design, 23 Factorial Design (Problems).			
Course Outcomes:			
CO1. Explain and report data set using data analysis , presentation and interpretation techniques to understand various phenomena in the fields of engineering.			
CO2. Apply various statistical processing techniques to handle a set of data to estimate probabilities.			
CO3. Apply an appropriate statistical tool and analyze a specific set of data to estimate and draw conclusions about population parameters.			
CO4. Draw inferences about population parameters and relations between variables based on analysis of sample data.			
CO5. Design and conduct engineering experiments involving 2 factors with 2 or 3 levels.			
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.

Text Books:

1. Applied statistics and Probability for Engineers – Douglas C Montgomery, George CRunger, 2ndEdn, John Wiley and Sons, ISBN-0-471-17027-5
2. Statistics for Management - Richard I Levin, David S Rubin, 6thEdn, Prentice Hall India, ISBN-81-203-0893-X

Reference Books:

1. Probability and Statistics in Engineering - William W Hines, Douglas C Montgomery, 2ndEdn, John Wiley and Sons
2. Business Statistics for Management and Economics - Daniel, Terrell, 6thEdn, Houghton Mifflin Company, ISBN-0-395-62835-0
3. Probability and Statistics - Walpole & Mayer, MacMillan Publishing Company, 1989.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - IV			
MATERIALS SCIENCE AND METALLURGY			
Course Code	18IM45	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To understand the different crystal structures • To understand concepts imperfection in crystals and their effects on properties of the material • To learn the mechanism of diffusion and distinguish between steady and non-steady types. • To appreciate the significance and construction of phase diagrams • To construct the iron carbon equilibrium diagram and identify different phases • To understand the properties of different metals resulting from different heat treatments • To understand Fatigue phenomena and creep mechanism • To have a knowledge of steels and cast irons, ferrous alloys, low, medium and high carbon, AISI designation steels. • To know the properties and applications of Ceramic materials • To understand different composite materials and their applications 			
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 affecting fatigue life. Creep behaviour: stress and temperature effects.			
Module-3			
Phase Diagrams: Solid solutions, Hume-Rothery rules-substitutional and interstitial solid solutions, Intermediate phases, Gibbs phase rule, construction of equilibrium diagrams, lever rule. Iron-carbon equilibrium diagrams: solidification of steels and cast irons, Invariant reactions, TTT curves, and continuous cooling curves.			
Module-4			
Heat Treatment of Metals: annealing, normalizing, hardening, and 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, properties and applications.			
Ceramics: Glasses, Glass – ceramics, clay products, refractories, abrasives.			
Composite materials: Types of matrix & reinforcements materials. Application of fiber reinforced, metal matrix and ceramic composites: Aerospace, automobile and military			
Course Outcomes: After the completion of the course, a student will			
<ul style="list-style-type: none"> • Estimate the impact of imperfection on the property of the material • Analyze steady and non-steady types of diffusion and solve related problems • Construct the iron carbon diagram and TTT curves. • Estimate the hardness and other properties of metals obtained from different heat treatment processes. • Select the right iron-carbon alloy for any given application. 			
Text Books:			
1. William D Callister, “An Introduction -Material’s Science and Engineering”, John Wiley and Sons India Pvt Ltd., 6th Edition, 2006 New Delhi.			
2. Smith -Foundation of Material Science and Engineering, 3rd Edition, McGraw Hill, 1997.			

3. Donald R Askland, Pradeep. P. Phule -Essentials of Materials for Science and Engineering, Thomson Engineering, 4th edition 2003.

Reference Books:

1. V Raghavan -Physical Metallurgy, Principles and Practices, PHI, 2nd Edition 2006, New Delhi.
2. Materials science and Metallurgy O.P Khanna, revised edition 2017. Dhanpat Rai Publications
3. James F Shackelford -Introduction to Material Science for Engineering, 6th edition
4. Pearson Prentice hall, New Jersey, 2006.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - IV			
WORK STUDY AND ERGONOMICS			
Course Code	18IM46	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Define concepts related to principles of productivity & work study as a tool for increasing the efficiency and effectiveness in organizational systems. 2. Differentiate the existing method, compare and propose a new method. 3. Recognize the usage of the various tools and techniques used in work measurement. 4. Demonstrate basic ideas of ergonomics and its design. 5. Analyze the 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, Micromotion study, Therbligs, SIMO Chart. Special Charts: Cyclegraph and Chronocycle graph - development, definition and installation of the improved method.			
Module-3			
Work Measurement: Definition, objectives, and work measurement techniques.			
Work sampling – Need, confidence levels, and sample size determination, conducting study with problems.			
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.			
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:

1. Recollect the basic concepts of productivity, work content and work study and define the objective and scope of Work Study.
2. 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.
3. 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.
4. Determine the basic concepts of Ergonomics and demonstrate a sound knowledge of Ergonomics in engineering applications.
5. 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	International Labor Organization	4th edition 1992
2	Human Factor in Engineering and Design	Mark. S. Sanders and Ernest. J Mc Cornick	Mc Graw-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 andbook	Wesley Woodson, Peggy Tillman and Barry Tillman	McGraw-Hill; 2ndedition	1992
5	Motion and Time Study	Ralph M. Barnes	Wiley International, 7th Edition	

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - IV			
MACHINE SHOP			
Course Code	18IML37/47	CIE Marks	40
Number of Lecture 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			
<ul style="list-style-type: none"> • To train students into 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 			
Experiments:			
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.			
PART – B			
Cutting of V Groove/ dovetail / Rectangular groove using a shaper.			
Cutting of Gear Teeth using Milling Machine.			
Course Outcomes:			
<ul style="list-style-type: none"> • Perform turning, facing, knurling, thread cutting, tapering, eccentric turning and allied operations, keyways / slots, grooves etc using shaper. • Perform gear tooth cutting using milling machine. • Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder, Surface Milling/Slot Milling. • Demonstrate precautions and safety norms followed in Machine Shop. • Exhibit interpersonal skills towards working in a team. 			
Scheme of Examination:			
One question is to be set from Part-A: 50 marks			
One question is to be set from either			
Part-B or Part-C: 30 marks			
Viva-voce: 20 marks			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - IV			
METROLOGY AND MEASUREMENTS LAB			
Course Code	18IML38/48	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments. 2. To illustrate the use of various measuring tools measuring techniques. 3. To understand calibration techniques of various measuring devices.			
PART – A			
1. Calibration of 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.			
PART – B			
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. Measurement using Optical Flats			
Course Outcomes:			
<ul style="list-style-type: none"> • To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer. • To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set. • To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats. • To measure cutting tool forces using Lathe/Drill tool dynamometer. • To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer. • To measure surface roughness using Tally Surf/ Mechanical Comparator. 			
Scheme of Examination:			
ONE question from part -A: 20 Marks			
ONE question from part -B: 40 Marks			
Viva -Voice: 20 Marks Total: 80 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 Programmes)

(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 $R(x) = e^{ax}, \frac{\sin ax}{\cos ax}, x^n$ 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	43 rd Edition, 2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
2	Engineering Mathematics Vol. I	Rohit Khurana	Cengage Learning	2015.

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
MANAGEMENT AND ENTREPRENEURSHIP			
Course Code	18IM51	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Demonstrate the concepts of management, planning, organizing and staffing. 2. Apply the knowledge to become entrepreneur. 3. Analyze and Differentiate the requirements towards the small-scale industries and project preparation 4. Analyze and choose the appropriate institutional support to succeed as an entrepreneur. 			
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, Development of Management Thought early management approaches- Modern management approaches.			
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 Coordination. Meaning and steps in Controlling- Essentials of a sound control system-Methods of establishing 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; 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 5year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT 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; Project Appraisal. 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:			
<ol style="list-style-type: none"> 1. Explain about the management and planning. 2. Apply the knowledge on planning, organizing, staffing, directing and controlling. 3. Describe the requirements towards the small-scale industries and project preparation 4. Choose the right institutional support for a given line of business. 			

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 Mc Graw Hill,	
2	Dynamics of Entrepreneurial Development & Management	Vasant Desai	Himalaya Publishing House	
Reference Books				
3	Management	Stephen P Robbins	Pearson Education/PHI-17 th Edition	2003.
4	Entrepreneurship Development	Poornima. M. Charantimath	Small Business Enterprises- Pearson Education	2006(2&4).
5	Management Fundamentals - Concepts, Application, Skill Development	Roberts Lusier	Thomson	

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - V			
OPERATIONS RESEARCH			
Course Code	18IM52	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objective: To analyze different situations in industrial and business scenario with limited resources and obtain optimal solution within given constraints.			
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.			
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.			
Module-5			
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.			
Course Outcomes: At the end of the course, the student will be able to: CO1: Solve problems with application of methodology of Operations Research so as to formulate decision making problems into OR models such as LP CO2: Apply the models of transportation and Assignment to incorporate rational decision making process in real life situations. CO3: Analyse Project networks for the duration and cost of Project CO4: Analyse business situations with the application of Queuing and Game theory techniques to determine value of game and measures of performance of a queuing system.			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
<ol style="list-style-type: none"> 1. Operations Research - P K Gupta and D S Hira, S Chand Publications, New Delhi, Recent edition. 2. Operations Research -S.D. Sharma – Kedarnath, Ramnath & Co – Recent edition. 			
Reference Books			
<ol style="list-style-type: none"> 1. Operation Research An Introduction, Taha H A, 8th Edition, 2004, PHI, ISBN: 0130488089. 2. Operations Research: Principles and Practice, Ravindran, Phillips, Solberg, 2nd Edition, 2007, John Wiley & Sons, ISBN8126512563 3. Introduction to Operation Research, Hiller and Liberman, 8th Edition, 2004, Tata McGraw Hill, ISBN: 			

0073017795.

4. Operations Research Theory and Application, J K Sharma, 2nd Edition, 2003, Pearson Education Pvt Ltd, ISBN: 0333-92394-4.

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - V			
QUALITY ASSURANCE AND RELIABILITY			
Course Code	18IM53	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • Understand basics of quality control and quality improvement • Construct control charts for variables and attributes to monitor processes and interpret the charts. • Perform process homogenization & process harmonization, & to estimate capability of various processes. • Develop strategies for selecting lots based on single sampling and double sampling plans. • Perform Reliability evaluation of Mechanical, Electrical, and Electronics systems. 			
Module-1			
Introduction: Dimensions of Quality, Statistical Methods for Quality, Quality costs, Seven QC tools. Quality assurance, departmental assurance activities, ISO 9000, 14000 standards.			
Statistical Process Control: Chance and assignable causes of variation. Statistical basis of control charts, Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational sub groups, statistical basis of control charts. Analysis of patterns of control charts.			
Module-2			
Control Charts for Variable and Attribute Data: Controls charts for mean and Range, Control charts for mean and standard deviation. Controls chart for fraction non- conforming (p, np charts), Control chart for non-conformities (c and u charts).			
Process capability – methods of estimating process capability, Process capability indices- C_p and C_{pk} .			
Module-3			
SAMPLING INSPECTION: Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determination of Average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk.			
Module-4			
STATISTICAL THEORY OF TOLERANCES: Application of statistical theory of tolerances to design tolerances in random assemblies and application in other areas. Gauge Repeatability & Reproducibility & Measurement system analysis.			
Module-5			
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, parallel and series-parallel device configurations, Redundancy and improvement factors evaluation.			
Course Outcomes:			
<ol style="list-style-type: none"> 1. Explain the fundamentals of quality control and improvement. 2. Apply modern statistical methods for process quality control and improvement. 3. Select suitable acceptance sampling schemes to reduce inspection effort and cost. 4. Apply statistical theory of tolerances to design tolerances in random assemblies. 5. Determine reliability in series, parallel and series-parallel device configurations. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
TEXT BOOKS			
<ol style="list-style-type: none"> 1. Introduction to statistical Quality Control - D C Montgomery – John Wiley and Sons – 3rd Edition. 2. Quality Planning & Analysis - J M Juran, Frank M Gryna – Tata McGraw Hill - 3rd edition 3. Statistical Quality Control - Grant and Leavenworth - McGraw Hill-6th Edition 			
REFERENCE BOOKS:			

1. The QS9000 Documentation Toolkit -Janet L Novak and Kathleen C Bosheers - Prentice Hall PTR - 2nd Edition.
2. ISO 9000 a Manual for Total Quality Management - Suresh Dalela and Saurabh - S Chand and Co. -1st Edition.

B. E. Industrial Engineering & Management				
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)				
SEMESTER - V				
ENGINEERING ECONOMY				
Course Code	18IM54	CIE Marks	40	
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60	
Credits	03	Exam Hours	03	
Course Learning Objectives:				
<ol style="list-style-type: none"> 1. Define the fundamentals of engineering economics. 2. Explain the concepts of decision making, problem solving, and comparison of the alternatives 3. Demonstrate the understanding of concept depreciation and replacement analysis. 4. Illustrate concept of money and its importance in evaluating the engineering projects. 5. 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, 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.				
Module-3				
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-4				
Depreciation: Introduction, methods of depreciation, problems.				
Replacement Analysis: Reasons- Deterioration, obsolescence, inadequacy, replacement criteria problems.				
Module-5				
Estimating and Costing: components of costs such as direct material cost, direct labor cost, Fixed, over – heads, factory costs, administrative – overheads, 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:				
<ol style="list-style-type: none"> 1. Demonstrate the importance of Engineering Economy in engineering decision making. 2. Compare the various alternatives based on economy fundamentals. 3. Compare of asset life using net annual worth - assets with equal and unequal lives. 4. Apply concepts of depreciation and find the value of assets. Demonstrate skills in replacement decisions. 5. Estimate the cost of engineering operations and processes by determining the elements of cost. 				
Question paper pattern:				
<ul style="list-style-type: none"> • 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	NVR. Naidu, KM Babu and G.Rajendra	New Age International Pvt. Ltd	2006.

Reference Books				
3	Engineering Economy	Theusen.G	PHI,	2002
4	Financial Management	I M Pandey	Vikas Publishing House	2002.
5	Engineering Economy	Paul Degarmo	Macmillan Pub, Co.	2001

B. E. Industrial Engineering & Management				
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)				
SEMESTER - V				
FACILITY PLANNING AND LAYOUT DESIGN				
Course Code	18IM55	CIE Marks	40	
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60	
Credits	03	Exam Hours	03	
Course Learning Objectives:				
<ol style="list-style-type: none"> 1. Recognize the importance of location, layouts and material handling 2. Determine different approaches to layout and draw activity relationship chart 3. Illustrate space requirements and demonstrate skills in area of allocation and construct the layout. 4. Examine the quantitative approaches to facility planning and identify the different models 5. Compare 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:				
<ol style="list-style-type: none"> 1. Identify the planning strategies for implementation, evaluation and maintaining the facility. 2. Arrive at suitable layout for given situations having understand different approaches. 3. Demonstrate the Space determination and area allocation procedure, construction of the layout. 4. Analyze the quantitative methods and models to determine for the plant location. Explain the warehouse and waiting line models. 5. Demonstrates the ideas on various types of layout and evaluation techniques using computers. 				
Question paper pattern:				
<ul style="list-style-type: none"> • 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	3 rd edition John, Wiley and sons	1991
2	Facility layout and location	Françoise, R.L. and White, J.A	McGraw Hill 2 nd edition	1994
Reference Books				
3	Plant layout design	James.M Moore	Mac Millan co.	1962
4	Facilities design	Sunderesh Heragu	PWS publishing company- ISBN-0-534-95183	August 2008
5	Facilities planning	Tompkins White	Wiley India Pvt ltd 3 rd edition	

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - V			
MATERIALS MANAGEMENT			
Course Code	18IM56	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives: To provide the students with the knowledge of			
<ol style="list-style-type: none"> 1. Systems approach to materials management 2. Forecasting and materials planning 3. Purchase procedure of raw materials and capital equipment's 4. Supplier relationship management. Inventory analysis and computerized stores management 			
Module-1			
Introduction: Dynamics of Materials Management - Materials Management at Micro-level, Materials Management at Macro-level. Definition of Material Management. Systems Approach to Materials Management: Systems Approach -, Function of Materials Department Interfaces, Benefits of the Integrated Systems Approach.			
Module-2			
FORECASTING, Objectives and the Materials Organization: Forecasting and Planning, Forecasting Methods, Objectives of Materials Management, Leadership Style, Materials Planning: Making the Materials Plan Work, the Materials Cycle and Flow Control System. Purchasing: Purchasing Principles, Procedures and Practices, Fundamental Objectives of Purchasing - Scope, Responsibility and Limitations, Sources of Supply and Supplier Selection, Purchasing Policy and Procedures.			
Module-3			
Purchasing in Materials Management System Concept: -Definition of purchasing terms Negotiation, Reciprocity, Cost-Plus Contracts, Hedging, Forward Buying, Buying Ethics, Principles and Standards of Purchasing, Make-or-Buy, Information, Legal Aspects of Purchasing, Law of Agency, Law of Contract, Legal Status of the Buyer, Warranties and Conditions, Right of Inspection, Right of Rejection, Vendor-Vendee Relations, Vendor Development, Vendor Rating.			
Module-4			
Purchasing Capital Equipment, Plant and Machinery: Responsibility and Decision, Purchasing v/s Leasing, International Buying, Import Purchasing, and Governmental Purchasing: Industrial Needs, Import Procedure and Documents, Basis of Licensing, Import Purchasing Procedures, Letter of Credit, Income-Tax Clearance, Customs Tariff-Registration of Licenses at Port. Governmental Purchasing Policy and Procedures, Tenders. Registration of Firms, Procedure for Registration, Terms of Registration, Removal of the Firms from the List, Blacklisting of Firms, Banning of Firms. Inventory Management and Control Systems: Definition of Inventories, The Need for Inventory Audits Control, Types of Inventories, Inventory Control			
Module-5			
Q-system or Quantity Control System or Re-order Point System-Effect of Quantity Discounts, P-system or Periodic Review or Periodic Count System or Replenishment System, Optional Replenishment System or "S, s" Policy. Discussion on ABC Analysis, advantages and disadvantages. MRP system and MPS system Materials Management Information System and Computer: MIS - Management and MM, Computer System for MIS and MM, In-process Materials and Management Control			
Course Outcomes: A student will be able to			
<ul style="list-style-type: none"> • Understand the dynamics of Material Management and system approach to materials managements. • Understand the organization of Material Management. • Understand applying and analyzing concepts and principles of management in purchasing. • Understand the requirements for the registration of firms. • Apply the equation to INV control and analyzing the INV system 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			

Text Book:

- K. Datta., **Materials Management**, PHI Pvt. Ltd, New Delhi, 2001.

Reference Book:

- P. Gopalakrishnan, **Handbook of Materials Management**, PHI Pvt. Ltd, New Delhi, 2002.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - V			
MECHANICAL LAB			
Course Code	18IML57	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices • Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves. 			
Experiments:			
PART – A			
(Individual experiments)			
Determination of Flash point and Fire point of lubricating oil using Abel Pensky Martins Apparatus			
Determination of Calorific value of solid and gaseous fuels.			
Determination of Viscosity of a lubricating oil using Redwoods and Say bolts – Viscometers.			
PART – B			
Group experiments			
Performance Tests on Four stroke Petrol and Diesel Engines, Calculations of IP, BP, Thermal efficiencies, SFC, FP and heat balance sheet			
Performance Test on Four stroke Petrol - Calculations of IP, BP, Thermal efficiencies, SFC. Multi cylinder petrol / diesel engine (Morse Test)			
Calibration of Venturi meter, Flow through pipes			
Performance test on centrifugal and reciprocating pumps			
Course Outcomes:			
<ul style="list-style-type: none"> • Perform experiments to determine the properties of fuels and oils. • Conduct experiments on engines and draw characteristics. • Test basic performance parameters of I.C. Engine 			
From part A one question: 30 Marks			
From part B one question: 50 Marks			
Viva –Voice : 20 Marks			
Total : 100 Marks			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - V			
WORK STUDY & ERGONOMICS LAB			
Course Code	18IML58	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
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 ergometer			
7. Effect of Noise, Light, Heat on human efficiency in work environments.			
Course Outcomes:			
<ul style="list-style-type: none"> • Demonstrate the use of tools and techniques of work study and ergonomics. • To record the activity systematically using different process charts and conduct method study. • To rate a worker doing various activities. • To determine standard time of a job. • To determine the effect of work on human body and also to determine the effect of noise, light, heat in work environment on productivity. 			
From part A one question: 30 Marks			
From part B one question: 50 Marks			
Viva –Voice : 20 Marks			
Total : 100 Marks			
REFERENCE BOOKS:			
1. ILO, Introduction to work study - III Revised Edition, 1981			
2. Motion and Time study - Ralph M Barnes; John Wiley, 8 th Edition, 1985.			
3. Engineered work Measurement - Wledon, ELBS , 1991			
4. Motion and Time study - Marvin E. Mundel-, PHI, 1 st edition			

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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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.	2 nd Edition, 2012
2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3 rd Edition 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental	Raman Sivakumar	Cengage learning,	2 nd Edition, 2005

	Science and Engineering		Singapur.	
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11 th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh & Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1 st Edition

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
SIMULATION MODELING AND ANALYSIS			
Course Code	18IM61	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives:			
1. Define basic concepts of simulation modelling and replicating the practical situations in organizations.			
2. Generate and test random number variates using different techniques and apply them to develop simulation models.			
3. Analyse and interpret output data produced by a model, and test validity of the model.			
Module-1			
Introduction to Simulation: Simulation, advantages & disadvantages, Areas of application, System environment, Components of a system, Model of a system, Types of models, steps in a simulation study.			
Simulation Examples: Simulation of Queuing systems, simulation of Inventory System			
Tutorial: Case study discussion on Queuing systems and Inventory System			
Module-2			
General Principles: Concepts in discrete events simulation, event scheduling/Time advance algorithm, simulation using event scheduling.			
Random Numbers: Properties, Generations methods, Tests for Random Number-Frequency test, Runs test, Gap Test, Poker Test			
Tutorial: Additional Problems on event scheduling.			
Module-3			
Random Variate Generation: Inverse Transform Technique-Exponential, Uniform, Weibull, Triangular distributions, direct transformation for Normal and log normal Distributions, convolution methods-Erlang distribution, Acceptance – Rejection Techniques – Poisson distribution			
Tutorial: Additional Problems on Acceptance – Rejection Techniques			
Module-4			
Analysis of Simulation Data: Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis			
Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models.			
Output Analysis: Stochastic Nature of output data, Measures of Performance and their estimation.			
Tutorial: Case study on discussion on testing for goodness of fit.			
Module-5			
Optimization via Simulation: Meaning, Difficulty, Robust Heuristics, Random Search Applications: Simulation of Manufacturing and Material Handling Systems, Simulation of Computer Systems			
Simulation Softwares: Selection of Simulation Software, Simulation packages, Experiment and Statistical Analysis tool, Trend in Simulation Software			
Tutorial: Discussion of features of recent simulation packages.			
Course Outcomes:			
CO1: Construct a model for a given set of data and motivate its validity.			
CO2: Experiment with real-world situations related to systems development decisions, originating from source requirements and goals.			
CO3: Examine the behaviour of a dynamic system and create an analogous model.			
CO4: Examine the behaviour of a dynamic system and create an analogous model.			
CO5: Interpret the results and apply it to solve real-world problem.			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
Discrete Event system Simulation – Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol - Pearson Education, Asia - III Edition, ISBN - 81- 7808 – 505 - 4.			

Reference Books:

1. Systems Simulation with Digital Computer –NarsinghDeo-PHI Publication (EEE), ISBN – 0-87692-028-8.
2. Simulation Modelling & Analysis – Averill M Law, W David Kelton - McGraw Hill International Editions – Industrial Engineering series, ISBN – 0-07-100803-9.
3. System Simulation - Geoffrey Gordon - Prentice Hall publication, 2nd Edition, 1978, ISBN:81-203-0140-4.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
OPERATIONS MANAGEMENT			
Course Code	18IM62	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • Importance of operations management. Able to forecast the demand for production sector. • Solve problems using appropriate techniques of forecast. • Study the decision methodology, understand Economic models, and statistical models Understand the aggregate planning and master scheduling methods. • Determine MRP and CRP to run the manufacturing and service sectors without interruption. • Formulate the optimum scheduling strategies and methods. 			
Module-1			
Operation Management Concepts: Introduction, Factors affecting productivity, Physical and information flows in a production system. The environment of operations, Historical development of production systems, Contributions of James Watt, Charles Babbage, Robert Owen, Thomas Alva Edition, Frederick Winslow Taylor, Henry Ford in development of production systems. The trend: Information and Non- manufacturing systems.			
Module-2			
Forecast demand: Introduction, Forecasting objectives, Forecasting variables, how forecasting methods are classified, explain opinion and judgmental methods, market trials method, Delphi technique, nominal group technique, components of time series, Problems on simple moving average, Weighted moving average, Simple (Single) exponential smoothing method, Regression and correlation method.			
Module-3			
Operations decision making: Introduction, Management as a science, Characteristics of decisions, framework for decision making, decision methodology, decision support systems, economic models, and statistical probability model.			
Aggregate Planning and Master scheduling: Introduction, Flow chart of Aggregate plan and master schedule, Aggregate planning guidelines, aggregate planning methods, Master scheduling objectives, Master scheduling methods.			
Module-4			
Materials and capacity requirements planning: Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities,			
Scheduling and controlling 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 mean flow time, 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 scheduling: Types of schedules, and scheduling 2 jobs on 'm' machines and problems by graphical method.			
Course Outcomes:			
<ul style="list-style-type: none"> • 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 techniques related to, aggregate planning / master scheduling. • Explain the effects of the evolution of MRP, Evaluate single machine scheduling and Flow shop scheduling. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
TEXT BOOKS			

1. Operations Management- Monks. J.G.- McGraw-Hill International Editions-1987.
2. Production and Operation Management- Paneerselvam. R-PHI- 2nd edition.

REFERENCE BOOKS:

1. Modern Production/ Operation Management- Buffa- Wiely India Ltd. – 4th edition.
2. Production and Operations Management- Chary. S. N – Tata McGraw Hill.- 3rd edition
3. Production and Operation Management- Adam and Ebert, PHI, 5th edition Financial Accounting and Costing.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
DATA ANALYTICS FOR ENGINEERS			
Course Code	18IM63	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives:			
Understand data input and accessing data using R			
Representation of data in graphical form			
Analyzing data using probability and statistics			
Inference of data using correlation and regression analysis.			
Module-1			
Introduction to R: Introduction R as a statistical software and language, R as a calculator, R preliminaries, Methods of data input, Data accessing or indexing, Some useful built-in functions, Graphics with R, Getting help, saving, storing and retrieving work, Exercises and solutions to exercises.			
Module-2			
Descriptive Statistics: Introduction, Diagrammatic representation of data, Graphical representation of data, Measures of central tendency, dispersion, skewness and kurtosis, Selection of representative samples, Exercises and solutions to exercises.			
Module-3			
Probability and probability distributions: Introduction, Probability: Definitions and properties, probability distributions, some special discrete distributions, continuous distributions, Exercises and solutions to exercises.			
Module-4			
Statistical Inference: Introduction, Sampling distribution of sample mean, Estimation of parameters, Plots to check normality, Hypothesis testing, Goodness of fit tests, Exercises and solutions to exercises.			
Module-5			
Correlation and Regression analysis: Introduction, Correlation, Inference procedures for correlation coefficient, Linear regression, Inference procedure for simple linear model, validation of linear regression model, Transformation of the variables, Polynomial regression models, Exercises and solutions to exercises.			
Course Outcomes: At the end of the course, the student will be able to:			
CO1: Make use of various data analysis techniques and derive conclusions.			
CO2: Make use of descriptive and inferential statistical techniques for data analysis.			
CO3: Perform exploratory data analysis on a given set of data including visualization techniques.			
CO4: Build regression models and use them for prediction.			
CO5: Build time series models and use them for prediction.			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
1. Statistics using R , Sudha G. Purohit, Sharad D. Gore and Shailaja R. Deshmukh, Narosa Publications, second edition -2015.			
Reference Books:			
1. “ R for Data Science ”, Dan Toomey, PACKT Publishing, 2014.			
2. “ Practical Data Science with R ”, Nina Zumel, John Mount, Manning Publications, 2014.			
3. “ Building a recommendation System with R ”, Suresh R Gorakala, Michelle Usuelli, PACKT Publishing, 2015.			
4. “ Learning Predictive Analytics with R ”, Eric Mayor, PACKT Publishing, 2015.			
5. “ Data Analytics with Open Source Tools ”, Philip K Janert, O’Reilly, 2010.			
6. “ Data Mining: Concepts and Techniques ”, Jiawei Han, Micheline Kamber, Jian Pei, The Morgan Kaufmann Series in Data Management Systems, 3 rd Edition, 2011.			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
FINANCIAL ACCOUNTING AND COSTING			
Course Code	18IM641	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives: understand the basic concepts and processes used to determine product costs			
<ul style="list-style-type: none"> • To be able to interpret cost accounting statements • To be able to analyze and evaluate information for cost ascertainment, planning, control and decision making. • To be able to solve simple cases. 			
Module-1			
FINANCIAL ACCOUNTING: Introduction to Book keeping: double-entry accounting, journal & ledger posting.			
FINANCIAL STATEMENTS & ANALYSIS: Trial balance, preparation of Trading and Profit & Loss account, and Balance sheet.			
Module-2			
RATIO ANALYSIS: Balance sheet ratio's, profit – loss account ratio's, and combined ratio's.			
Module-3			
COSTING: Objectives of costing, Elements of costing, methods of costing preparation of cost sheet (job costing) Process costing, Marginal costing and absorption costing.			
Module-4			
STANDARD COSTING: Material, labour, overhead cost variance.			
ACTIVITY BASED COSTING: Target Costing, Activity Based Costing and management			
WORKING CAPITAL MANAGEMENT: Factors influencing working capital requirement, determination of operating cycle and working capital			
Module-5			
Budgeting: Sales budget, production budget, raw materials purchasing budget, selling and administrative expense budget, cash budget, Flexible Budget & Master budget.			
Course Outcomes:			
<ul style="list-style-type: none"> • Demonstrate knowledge of basic accounting techniques and preparation of journal, ledger and final statements of accountancy. Judge the financial strength of the firm through ratio analysis and understands the principle of costing. • Practice and enhanced the knowledge on costing through techniques like process costing, marginal costing and standard costing. • Calculate working capital requirement and learn to prepare budget for effective financial control of an organization. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
1 Cost Accounting-Khan M Y and Jain P K, Tata Mc Graw hill			
2 Financial Management- Prassana Chandra, Tata Mc Graw Hill			
3 Management Accounting & costing Prasad N K			
4 Financial Management & costing- James C Vanhorne, Pearson Education			
Reference Books:			
1 Elements of Accountancy B S Raman			
2 Practical Costing- Ahuja, Pandey, Khanna and Arora, S Chand & Co			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
HUMAN RESOURCE MANAGEMENT			
Course Code	18IM642	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Credits – 03			
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. To understand the HRM concepts and theory. 2. To obtain an overview of various HRM functions and practices. 3. To gain an insight into the various statutory provisions. 			
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:			
<ol style="list-style-type: none"> 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. 4. List out the regulations governing employee benefit practices. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
TEXT BOOKS:			
<ol style="list-style-type: none"> 1. Human Resources Management – Dr. K Ashwathappa – Tata McGraw Hill - Edition 1999. 2. Management of Human Resources – CB Matoria – Himalaya Publication House – 2003. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Personnel / Human resource Management – Decenoz and robbins- PHI - 2002 2. Industrial Relations – ArunMonappa – TMH - ISBN – 0-07-451710-8. 3. Human Resources Management – VSP Rao 4. Human Resources Management – Ravi Dharma Rao 			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
MANAGEMENT INFORMATION SYSTEMS			
Course Code	18IM643	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Introduce various aspects of MIS as applied to engineering problems in a systematic manner. 2. Impart the knowledge of fundamentals of data base, business applications. 			
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. Electronics 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:			
<ol style="list-style-type: none"> 1. To understand fundamentals of MIS and be able to compare it with other approaches. 2. Identify and utilize fundamentals of data base management as applied to the respective tasks. 3. Demonstrate the ability to define and formulate the properties and characteristics of data base management by any engineer. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
Management Information systems – managing information technology in the internet worked enterprise – jams. A O'Brien – Tata McGraw Hill publishing company limited – 2002. 2. Management Information Systems – Laudon & Laudon – PHI – ISBN 81-203-1282-1.1998.			
Reference Books:			
Management Information systems – S. Sadogopan. – PHI – 1998Edn. ISBN 81-203-1180-9. 2. Information systems for modern management – G.R. Murdick – PHI – 2nd Edition.			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
DATA BASE MANAGEMENT SYSTEM			
Course Code	18IM644	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Credits – 03			
Course Learning Objectives:			
The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.			
Module-1			
DATABASES AND DATABASE USERS: Introduction, characteristics of data base approach, intended uses of a DBMS, advantages and implication of database approach.			
DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE: Data models, Schemas and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of data base management systems.			
Module-2			
DATA MODELING: High level conceptual data models for database design. Entity types, entity sets, attributes, and keys. Relationships, relationship types, roles and structural constraints. Weak entity types. ER diagrams			
RECORD STORAGE AND PRIMARY FILE ORGANIZATION: Secondary storage devices, buffering of blocks, placing file records on disk, operations on files, heap files and sorted files, hashing techniques.			
Module-3			
INDEX STRUCTURE OF FILES: Single-level and multilevel ordered indexes, dynamic multi level indices using B-trees and B+ trees.			
RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA: Brief discussion on Codd rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations and queries in relational algebra.			
Module-4			
Structured Query Language (SQL): Data definition in SQL2. Basic and complex queries in SQL. Insert, delete, update statements, and views in SQL, embedded SQL.			
DATABASE DESIGN: Design guidelines for relational schemes, functional Dependencies, normalization -1 st , 2 nd , 3 rd , 4 th , and 5 th normal forms. Database design process, factors influencing physical database design guidelines and guidelines for relational systems.			
Module-5			
SYSTEM IMPLEMENTATION: System cat log for RDBMS, transaction processing and system concepts, properties of transactions, brief discussion on concurrency, control and recovery techniques, database security and authorization.			
Course Outcomes: Upon successful completion of this course, students should be able to:			
<ul style="list-style-type: none"> • Describe the fundamental elements of relational database management systems • Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL. • Design ER-models to represent simple database application scenarios • Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data. • Improve the database design by normalization. • Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
1. Fundamentals of database systems -Ramez Elmasri and Shamkanth B. Navathe - Addison Wesley Publishing Company - 6 th Edition.			
2. Database Management System - Raghu Ramakrishnan and Johannes Gehrke - TATA McGraw Hill -			

3rd Edition - ISBN 0-07-1231511

Reference Books:

1. **Database Management Design** - Gary W. Hansen and James V. Hanesn - PHI Pvt. Ltd. - 2nd Edition.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
Course Code	18IM651	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Credits – 03			
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Will be able to understand about value 2. Can adopt functional approach in identifying unnecessary cost in a product 3. Can apply the value methodology 4. Can analysis value of the product and service and apply VA/VE technique to increase the value 			
Module-1			
<p>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.</p> <p>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.</p> <p>Detailed case studies of simple products</p>			
Module-2			
<p>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.</p> <p>PROBLEM SETTING & SOLVING SYSTEM: A problem solvable stated is half solved, Steps in problem setting system, Identification, Separation and Grouping of functions. Case studies.</p> <p>PROBLEM SETTING & SOLVING SYSTEM: Goods system contains everything the task requires. Various steps in problem solving, case studies.</p>			
Module-3			
<p>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.</p>			
Module-4			
<p>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.</p> <p>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).</p> <p>TOTAL VALUE ENGINEERING: Concepts, need, Methodology and benefits.</p>			
Module-5			
<p>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.</p>			
Course Outcomes: After the completion of the course, a student will			
<ol style="list-style-type: none"> 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 			

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.

Text Books:

1. Techniques of Value Analysis and Engineering– Lawrence D. Miles, McGraw – Hill Book Company, 2ndEdn.
2. Value engineering for Cost Reduction and Product Improvement – M.S. Vittal, Systems Consultancy Services Edn 1993
3. Value Management, Value Engineering and Cost Reduction – Edward D Heller Addison Wesley Publishing Company 1971

Reference Books:

1. Value Analysis for Better Management – Warren J Ridge American Management Association Edn 1969
2. Getting More at Less Cost (The Value Engineering Way) – G.Jagannathan Tata McGraw Hill Pub. Comp. Edn 1995
3. Value Engineering – Arther E Mudge McGraw Hill Book Comp. Edn 1981

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
DATA ANALYTICS FOR ENGINEERS			
Course Code	18IM652	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
Understand data input and accessing data using R			
Representation of data in graphical form			
Analyzing data using probability and statistics			
Inference of data using correlation and regression analysis.			
Module-1			
Introduction to R: Introduction R as a statistical software and language, R as a calculator, R preliminaries, Methods of data input, Data accessing or indexing, Some useful built-in functions, Graphics with R, Getting help, saving, storing and retrieving work, Exercises and solutions to exercises.			
Module-2			
Descriptive Statistics: Introduction, Diagrammatic representation of data, Graphical representation of data, Measures of central tendency, dispersion, skewness and kurtosis, Selection of representative samples, Exercises and solutions to exercises.			
Module-3			
Probability and probability distributions: Introduction, Probability: Definitions and properties, probability distributions, some special discrete distributions, continuous distributions, Exercises and solutions to exercises.			
Module-4			
Statistical Inference: Introduction, Sampling distribution of sample mean, Estimation of parameters, Plots to check normality, Hypothesis testing, Goodness of fit tests, Exercises and solutions to exercises.			
Module-5			
Correlation and Regression analysis: Introduction, Correlation, Inference procedures for correlation coefficient, Linear regression, Inference procedure for simple linear model, validation of linear regression model, Transformation of the variables, Polynomial regression models, Exercises and solutions to exercises.			
Course Outcomes: At the end of the course, the student will be able to:			
CO1: Make use of various data analysis techniques and derive conclusions.			
CO2: Make use of descriptive and inferential statistical techniques for data analysis.			
CO3: Perform exploratory data analysis on a given set of data including visualization techniques.			
CO4: Build regression models and use them for prediction.			
CO5: Build time series models and use them for prediction.			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
1“ Statistics using R ”, Sudha G. Purohit, Sharad D. Gore and Shailaja R. Deshmukh, Narosa Publications, second edition -2015.			
Reference Books:			
1. “ R for Data Science ”, Dan Toomey, PACKT Publishing, 2014.			
2. “ Practical Data Science wit R ”, Nina Zumel, John Mount, Manning Publications, 2014.			
3. “ Building a recommendation System with R ”, Suresh R Gorakala, Michelle Usuelli, PACKT Publishing, 2015.			
4. “ Learning Predictive Analytics with R ”, Eric Mayor, PACKT Publishing, 2015.			
5. “ Data Analytics with Open Source Tools ”, Philip K Janert, O’Reilly, 2010.			
6. “ Data Mining: Concepts and Techniques ”, Jiawei Han, Micheline Kamber, Jian Pei, The Morgan Kaufmann Series in Data Management Systems, 3 rd Edition, 2011.			

B. E. Industrial Engineering & Management				
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)				
SEMESTER - VI				
ENGINEERING ECONOMY				
Course Code	18IM653	CIE Marks	40	
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60	
Credits	03	Exam Hours	03	
Course Learning Objectives:				
<ul style="list-style-type: none"> • Define the fundamentals of engineering economics. • Explain the concepts of decision making, problem solving, and comparison of the alternatives • Demonstrate the understanding of concept depreciation and replacement analysis. • Illustrate concept of money and its importance in evaluating the engineering projects. • 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, 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.				
Module-3				
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-4				
Depreciation: Introduction, methods of depreciation, problems.				
Replacement Analysis: Reasons- Deterioration, obsolescence, inadequacy, replacement criteria problems.				
Module-5				
Estimating and Costing: components of costs such as direct material cost, direct labor cost, Fixed, over – heads, factory costs, administrative – overheads, 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:				
<ol style="list-style-type: none"> 6. Demonstrate the importance of Engineering Economy in engineering decision making. 7. Compare the various alternatives based on economy fundamentals. 8. Compare of asset life using net annual worth - assets with equal and unequal lives. 9. Apply concepts of depreciation and find the value of assets. Demonstrate skills in replacement decisions. 10. Estimate the cost of engineering operations and processes by determining the elements of cost. 				
Question paper pattern:				
<ul style="list-style-type: none"> • 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. 				
Reference Books				
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	NVR. Naidu, KM Babu and	New Age InternationalPvt. Ltd	2006.

3	Engineering Economy	Theusen.G	PHI,	2002
4	Financial Management	I M Pandey	Vikas Publishing House	2002.
5	Engineering Economy	Paul Degarmo	Macmillan Pub, Co.	2001

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
DATA ANALYTICS LAB			
Course Code	18IML66	CIE Marks	40
Number of Tutorial/Practical/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To understand and summarize the data-sets numerically and graphically. • To select appropriate probability distribution for a given situation and test its goodness of fit. • To make estimates and inferences using the software and take decisions in the presence of uncertainty. • To identify the magnitude and direction of relationship between the independent and dependent variables. 			
Experiments:			
<ol style="list-style-type: none"> 1. Exercises on reading data from files and working with datasets 2. Exercises on basic built-in functions, plots, storing and retrieving data (At least one problem on each of the functions). 3. Exercises on diagrammatic and graphical representation of data. 4. Exercises on measures of central tendency and dispersion. 5. Exercises on skewness and kurtosis 6. Exercises on continuous probability distribution. 7. Exercises on discrete probability distribution. 8. Exercises on hypothesis testing one single population mean. 9. Exercises on normality test. 10. Exercises on goodness of fit (Normal, Binominal, Poisson distribution, uniform distribution). 11. Exercises on correlations and regression analysis. 12. Writing simple programs in R 			
Suggested software packages: R studio			
Course Outcomes:			
CO1: Examine and present the real-time data in appropriate form.			
CO2: Choose suitable probability distribution for a given situation and test its goodness of fit.			
CO3: Formulate the hypothesis by arriving at estimates and inferences to make decisions in uncertainty.			
CO4: Perform correlation and regression analysis and draw inferences.			
Any 2 questions from the exercise given above: 40 marks for each question			
Viva –Voice : 20 Marks			
Total : 100 Marks			
TEXT BOOKS:			
<ol style="list-style-type: none"> 1. Douglas C. Montgomery, George C. Runger, Norma F. Hubele, “Engineering Statistics”, John Wiley and Sons, 5th Edn, ISBN-13: 978-0470631478 ISBN-10: 0470631473 year: 2010. 2. “Statistics using R”, Sudha G. Purohit, Sharad D. Gore and Shailaja R. Deshmukh, Narosa Publications, second edition -2015. 3. “R for Data Science”, Dan Toomey, PACKT Publishing, 2014. 4. “Practical Data Science wit R”, Nina Zumel, John Mount, Manning Publications, 2014. 5. “Building a recommendation System with R”, Suresh R Gorakala, Michelle Usuelli, PACKT Publishing, 2015. 			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
QUALITY ENGINEERING LAB			
Course Code	18IML67	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • Measure need to improve the quality of a process. • Quantitative technique used for identifying and reducing the deviation of a product quality. • Reliability of machine and effect of failure. 			
PART – A			
To test the Goodness of fit for the given quality characteristic using: Uniform distribution, Binomial distribution, Poisson distribution & Normal distribution.			
Conduction of Repeatability and Reproducibility studies for appraiser and instrument using R&R Software			
Assessing Process Capability of the given manufacturing process using Normal Probability paper method and process capability indices			
Assessing Process Capability of the given manufacturing process using Digital Motorized Multifunctional Height Gauge and SQC Display unit			
PART – B			
<ol style="list-style-type: none"> 1. Experiments on Application of 7 QC Tools as applied to Manufacturing and Service Operations. 2. Construction of control chart for variable quality characteristic using 3. Digital Motorized Multifunctional Height Gauge 4. SQC Display unit 5. SQC/SPC software 6. Construction of control chart for attribute quality characteristic 7. Construction of control charts using SYSTAT Software 8. Attribute sampling Plans – Single, Double and Multiple sampling plans. 9. Experiments on correlation and Simple linear regressions 10. Experiments on multiple linear regressions 11. Conduction of Design of Experiments – Full Factorial approach for the given quality characteristic for machining operations. 12. Exercises to demonstrate Taguchi’s Orthogonal Array technique through DOE software. 13. Exercises on FMEA and Reliability 14. Exercises on QFD 			
Course Outcomes: At the end of this course, the students will be able to;			
<ul style="list-style-type: none"> • Explain the procedure for conducting the Chi-square test for discrete distribution and continuous distribution data. • Predict the process stability and capability using attribute and variable control charts for the data obtained from manufacturing process. • Apply the DOE, Reliability, Repeatability and Reproducibility test for the given process. 			
From part A one question: 30 Marks			
From part B one question: 50 Marks			
Viva –Voice : 20 Marks			
Total : 100 Marks			
REFERENCE BOOKS:			
<ol style="list-style-type: none"> 1. ILO, Introduction to work study - III Revised Edition, 1981 2. Motion and Time study - Ralph M Barnes; John Wiley, 8th Edition, 1985. 3. Engineered work Measurement - Wledon, ELBS , 1991 4. Motion and Time study - Marvin E. Mundel-, PHI, 1st edition 			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VI			
MINI PROJECT			
Course Code	18IMMP68	CIE Marks	40
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	60
Credits	02	Exam Hours/Batch	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • 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. □ 			
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:			
<ul style="list-style-type: none"> • 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 Engineering & Management
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

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 as fail and shall have to complete during subsequent University examinations after satisfying the internship requirements.

Course Code	Refer to VIII semester scheme	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. □

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B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
ENTERPRISE RESOURCE PLANNING			
Course Code	18IM71	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Apply the principles of ERP systems, their major components, and the relationships among components. 2. With the knowledge of typical ERP systems, and the advantages and limitations of implementing ERP systems. 3. To comprehend the technical aspects of ERP systems. 4. To be able to map business processes using ERP concepts and techniques. 			
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 Utilization, Better Customer Satisfaction, Improved Supplier 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:			
<ol style="list-style-type: none"> 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 3. Design the ERP implementation strategies. 4. Create reengineered business processes for successful ERP implementation. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
<ol style="list-style-type: none"> 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:

1. Manufacturing Planning & Controls -Thomas Volloman, et.al.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
VALUE ENGINEERING			
Course Code	18IM72	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Will be able to understand about value 2. Can adopt functional approach in identifying unnecessary cost in a product 3. Can apply the value methodology 4. Can analysis value of the product and service and apply VA/VE technique to increase the value 			
Module-1			
<p>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.</p> <p>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.</p> <p>Detailed case studies of simple products</p>			
Module-2			
<p>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.</p> <p>PROBLEM SETTING & SOLVING SYSTEM: A problem solvable stated is half solved, Steps in problem setting system, Identification, Separation and Grouping of functions. Case studies.</p> <p>PROBLEM SETTING & SOLVING SYSTEM: Goods system contains everything the task requires. Various steps in problem solving, case studies.</p>			
Module-3			
<p>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.</p>			
Module-4			
<p>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.</p> <p>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).</p> <p>TOTAL VALUE ENGINEERING: Concepts, need, Methodology and benefits.</p>			
Module-5			
<p>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.</p>			
Course Outcomes: After the completion of the course, a student will			
<ul style="list-style-type: none"> • Able to understand the importance of value of a product • Find out unnecessary cost/ function involved in the product • Conduct value engineering methodology • Do value analysis using advanced value engineering techniques • Become a certified value engineer with additional course /training 			

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.

Text Books:

1. Techniques of Value Analysis and Engineering– Lawrence D. Miles, McGraw – Hill Book Company, 2ndEdn.
2. Value engineering for Cost Reduction and Product Improvement – M.S. Vittal, Systems Consultancy Services Edn 1993
3. Value Management, Value Engineering and Cost Reduction – Edward D Heller Addison Wesley Publishing Company 1971.

Reference Books:

1. Value Analysis for Better Management – Warren J Ridge American Management Association Edn 1969.
2. Getting More at Less Cost (The Value Engineering Way) – G.Jagannathan Tata Mcgraw Hill Pub. Comp. Edn 1995.
3. Value Engineering – Arther E Mudge McGraw Hill Book Comp. Edn 1981.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
PROJECT MANAGEMENT			
Course Code	18IM731	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • Describe major activities and deliverable at each project life cycle stage, strategic planning and portfolio alignment processes. • Understand the organizational capability in terms of structure, culture and stakeholders requirements. • Learn project scheduling and identify the resource needs for a project • Describe how to plan for risk management, stages of team development and strategies for managing. • Create and present a project progress report and describe the importance of the project closing activities and how to perform them. 			
Module-1			
Introduction: Definition of project, History of Project Management, Understanding projects, Project roles.			
Project Selection and Prioritization – Strategic planning process, portfolio alignment, securing and negotiating projects.			
Module-2			
Organizational capability: Types of organizational structures, organizational culture and its impact on projects, project life cycles, project executive roles, project management roles, project team roles.			
Planning Projects: Defining the project scope, scope planning, collect requirements, Project scope checklist, Work Breakdown Structure (WBS, establish change control.			
Module-3			
Scheduling projects: Introduction to project time management, purposes of a project schedules, Historical development of project schedules, how project schedules are limited and created, define activities, sequence activities, estimate activity duration, develop project schedules, uncertainty in project schedules, show the project schedule on a gantt chart.			
Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plan, project team composition issues, assign a resource to each activities, dealing with resource overloads, compress the project schedule, alternative scheduling methods.			
Module-4			
Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning			
Leading and managing project teams: Acquiring the project team, developing the project team, managing and leading the project team, managing stakeholders expectations, managing project conflicts.			
Module-5			
Determining project progress and results: project balanced scorecard approach, internal project issues, customer issues, financial issues.			
Finishing the project and realizing the benefits: Verify scope, close procurements, close project, post project activities.			
Course Outcomes:			
<ul style="list-style-type: none"> • Apply to the given situation, the fundamental concepts and basic principles of project management, selection and prioritization. • Utilize appropriately the knowledge of organizational capability, project planning and scheduling for successful execution of projects. • Identify and assign resource for a project, compress the project schedule and plan risk management. • Analyze project progress through managing project teams, results and realization of benefits in Project Management. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			

TEXT BOOKS :

1. Contemporary Project Management, Timothy J Kloppenborg, Cengage Learning, Second Edition 2012.
2. Project Management, A systems approach to planning scheduling and controlling by Harold kerzner, CBS publication.
3. Project Management by S Choudhury, Mc Graw Hill Education (India) Pvt. Ltd. New Delhi, 2016

REFERENCE BOOKS :

1. Project Management, Pennington Lawrence, Mc Graw hill
2. Project Management, A Moder Joseph and Phillips New Yark Van Nostrand, Reinhold.
3. Project Management, Bhavesh M. Patal, Vikas publishing House..

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
MARKETING MANAGEMENT			
Course Code	18IM732	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
1 have acquired analytical skills in solving marketing related problems and challenges and be familiar with the strategic marketing management process.			
2 train participants to apply concepts and techniques in marketing so that they become acquainted with the duties of a marketing manager.			
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 – economics 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 power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users			
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: On completion of this Course students will be able to:			
<ul style="list-style-type: none"> • Identify and understand core concepts of marketing and the role of marketing in business and society. • Apply the concepts of marketing management and information system to make a successful organization • Analyze and Determine strategies for developing new products and services that are consistent with evolving market needs. • Develop and evaluate pricing strategies that take into account perceived value, competitive pressures and corporate objectives. • Identify the roles of sales promotion, public relations, personal selling and develop integrated marketing plan to the promotional mix 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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.

TEXT BOOKS:

1. Principles of Marketing - Philip Kotler - Prentice Hall - 11thEdn.
2. Marketing Management - Philip Kotler , Prentice Hall - 12thEdn.

Reference Books:

1. Fundamentals of Marketing - Wiliam J Stanton - McGraw Hill – 1994.
2. Marketing Management Text & Cases - Rajagopal- Vikas Publishing House - ISBN 81-259-0773-4.
3. Marketing Management - Michael R Czinkota - Vikas Publishing House - 2nd Edition ISBN 981-240-366-3

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
STRATEGIC MANAGEMENT			
Course Code	18IM733	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. To provide insights into the core concepts of strategic management. 2. To evaluate various business strategies in dynamic market environments. 3. To gain insights into various strategic management models 			
Module-1			
STRATEGIC MANAGEMENT INTRODUCTION: Definition- Levels of strategy- Roles of Strategist- Strategic Management Process benefits and limitations. Mission Objectives -Social responsibilities.			
Module-2			
STRATEGY FORMULATION: Strategic Thinking, SWOT analysis- Techniques for environmental analysis- TOWS matrix, Balanced Score Card, Steps in strategy implementation -formulation of SBU strategy. Leadership implementation communicating the strategy - Annual and Functional objectives- Development of policies- Organisational Implementation- Evaluation and control. reward system.			
Module-3			
STRATEGY AND STRUCTURE: Strategy- Structure relationship. Organizational restructuring and Transformation, Principles of Organization. STRATEGY EVALUATION AND CONTROL: Strategic control- Premise and Implementation control strategic Surveillance special alert control- Operational control- Steps in Operational Control, Types of Operational control.			
Module-4			
PORTFOLIO STRATEGY: Business portfolio analysis- BGC matrix, GE multi matrix, an evaluation of Portfolio models - factors influencing portfolio strategy.			
Module-5			
COMPETITIVE ANALYSIS AND STRATEGIES: Structural analysis of industries threat of entry rivalry among existing competitors, threat of substitutes; Bargaining power of suppliers; structural analysis and competitive strategy -competitor analysis value chain.			
Course Outcomes:			
<ol style="list-style-type: none"> 1. Formulate a strategic plan that operationalizes the goals and objectives of the firm. 2. Use management concepts to analyze complex business situations 3. Associate with various Strategic Management models for Business situations 4. Ability to evaluate and critique theories and models in corporate environment. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
<ol style="list-style-type: none"> 1. Strategic Management - Francis Cherunilam - Himalya Publishers, 2. Business Policy and Strategic Management - AzharKazmi - Tata McGraw Hill -2ndEdn. 3. Strategic Management - Michael Porter - Prentice-Hall – 1984. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Business Policy and Strategic Management - P SubbaRao - Himalya Publishers - 1st Edition. 2. Corporate Strategic Management -R.M.Srivastava, PragatiPrakashan ,Meerut - 1st Edition. 3. Strategic Management – Robert A Pitts and David Lei - Vikas Publishing House- 1st Edition. 4. Business Environment for Strategic Management - K.Aswantappa- Himalaya Publishers -1st Edition. 			

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
SOFTWARE ENGINEERING & MANAGEMENT			
Course Code	18IM734	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Ability to apply software engineering principles and techniques. 2. To produce efficient, reliable, robust and cost-effective software solutions. 3. Ability to work as an effective member or leader of software engineering teams. 4. To manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals Identify and analyzes the common threats in each domain. 			
Module-1			
THE PRODUCT AND THE PROCESS: The product - Characteristics, Components, and Applications. The Process -Software process Models - Linear, sequential, Prototype, RAD, Process Technology, Software Development Life cycle.			
SOFTWARE PROJECT MANAGEMENT CONCEPTS: The Management Specification, People, Problem, Process, project.			
Module-2			
SOFTWARE PROJECT PLANNING: Objectives, Scope, Resource, Project estimation, Decomposition Techniques – software sizing, problem-based estimation, process-based estimation, Empirical Estimation Models. Make-buy decision, Automated estimation tools.			
Module-3			
RISK MANAGEMENT: Reactive v/s Proactive Risk Strategies, Software Risks, Risk identification, Risk projection, Monitoring.			
SOFTWARE PROJECT SCHEDULING AND TRACKING: Basic concepts, defining a task set selection, Defining Scheduling, Project Plan.			
Module-4			
SOFTWARE QUALITY ASSURANCE: Quality assurance concept, Cost impact of software defects, Technical review, statistical Quality assurance, software reliability, ISO 9000 Quality standards			
SOFTWARE TESTING: Objectives, Principles, Testability.			
Module-5			
SOFTWARE QUALITY AND RELIABILITY: Introduction, software modularity, language, Data reliability, Fault tolerance, software checking and software testing. 4 Hours			
OBJECT ORIENTED CONCEPT AND PRINCIPLES: Object Oriented Concepts, Identifying the elements of an object model.			
Course Outcomes: After the completion of the course, a student will			
<ul style="list-style-type: none"> • Examine and understand the concepts of the software product, process and project management. • Analyze software project planning as to how project is estimated and recognize when planner decides to make or buy a software • Interpret the ways of managing risk, scheduling and tracking a software project • Explain the object-oriented concepts and analyze the elements of an object model with case studies. 			
Text Books:			
1. Software Engineering – Pressman - Computer Science Series - TATA McGraw-Hill Publications - 6th edition			
Reference Books:			
1 Software Engineering – Somerville - Pearson Education,			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
ORGANIZATIONAL BEHAVIOR			
Course Code	18IM741	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. To make students understand fundamental concepts and principles of management, including the basic roles, skills, and functions of management. 2. To make students knowledgeable of historical development, theoretical aspects and practice application of managerial process. 3. To understand the basic concepts and theories underlying individual behaviour besides developing better insights into one's own self. 4. To make students aware of Individual behaviour in groups, dynamics of groups and team building besides developing a better awareness of how they can be better facilitators for building effective teams as leaders themselves. 			
Module-1			
Introduction: Definition of Organization Behaviour and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems).			
Foundations of individual behavior: individual differences. Ability: Intellectual abilities, Physical ability, the role of disabilities. Attitude: Meaning, Formation, components of attitudes, relation between attitude and behavior, Aptitude, interests. Values.			
Module-2			
Personality: Meaning, formation, determinants, traits of personality, big five and MBTI, personality attributes influencing OB. Personality Job Fit Theory.			
Learning: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement.			
Module-3			
Perception: Meaning, Process of perception, factors influencing perception, link between perception and individual decision-making.			
Module-4			
Motivation: Maslow's Hierarchy of Needs theory, Mc-Gregor's theory X and Y, Hertzberg's motivation Hygiene theory, David Mc-Clelland's three needs theory, Victor Vroom's expectancy theory of motivation.			
Leadership: Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories.			
Module-5			
Group Behavior: Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making.			
Course Outcomes: At the end of the course the student will be able to:			
<ol style="list-style-type: none"> 1. Demonstrate their conceptual skills understanding and application of principles and functions of management and to enable students basic understanding of dynamics of OB 2. Evaluate the global context for taking managerial actions of planning, Organizing and Controlling and application of concepts of planning like MBO and Managerial decision making. 3. The Student will demonstrate ability to analyze predicting and to control behaviour of people at work for organization effectiveness. 4. Students to develop leadership skills and ability to motivate and work in groups to achieve organizational goals. 5. Understand and demonstrate their exposure towards growing complexities and recent trends in management. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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	Organizational Behaviour	Stephen P Robbins, Timothy A. Judge, SeemaSanghi	-Pearson Education	14th Edition, 2012
2	Organization Behaviour	Ashwathappa,	Himalaya Publication House	
Reference Books				
3	Organizational Behavior	Fred Luthans	Tata Mc Graw HILL	
4	Organizational Behavior.	PG Aquinas	Excel Books	

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
DESIGN OF EXPERIMENTS			
Course Code	18IM742	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • An ability to design and conduct experiments, as well as to analyze and interpret data. • An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability • An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. 			
Module-1			
Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments. 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			
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 examples.			
Module-3			
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, 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.			
Module-5			
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.			
Course Outcomes: After completing the module, students will be able to:			
<ul style="list-style-type: none"> • apply the basics of statistical inference (estimation, testing, confidence regions) in the course setting • perform a correct statistical analysis of different types of designs, including unbalanced data sets, 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
<ul style="list-style-type: none"> • Box GEP, Hunter JS, Hunter WG, 2005. Statistics for Experimenters. 2nd ed. Wiley. • Design and Analysis of Experiments, 8ed, ISV (WSE) Paperback – 2013 by Douglas C. Montgomery 			
Reference Books:			
<ul style="list-style-type: none"> • Dean A, Voss D, 1999. Design and Analysis of Experiments. Springer. 			

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII			
WORLD CLASS MANUFACTURING			
Course Code	18IM743	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • Understand the different principles of world class manufacturing. • Principles of WCM, value stream mapping. • Benchmarking of process and training. 			
Module-1			
INTRODUCTION TO WORLD CLASS MANUFACTURING			
Manufacturing Excellence and Competitiveness, What is world-Class Manufacturing?-Halls framework of world-Class Manufacturing (WCM), Gunn s Model of World-Class Manufacturing, Maskells Model of World-Class Manufacturing.			
WORLD CLASS MANUFACTURING			
The philosophy of world-class Manufacturing-The First Principles of World-Class Manufacturing, The practices of World-Class Manufacturing-The customers Interface ,The Supplier Interface, World-Class Practices in the factory.			
Module-2			
PRINCIPLES AND PRACTICIES OF WCM			
Data collection plan, research-internal public domain sources, outside experts etc , original research, site visits, and code of conduct, Analyzing the gap: Top displaying data, deciding and combining best work practices, Balance Score Card Technique, Value Stream Mapping, validation, recommendations etc			
Module-3			
BENCHMARKING			
Definition, mission and objectives, managing benchmarking process, training and code of conduct, future scope and benchmarking process , What to benchmark: concept of step zero, priorities, business processes linking to goals etc, investigation, documentation, performance measures, improving business processes , Whom to benchmarks: Developing candidate list, systematic search, refining the initial list			
Module-4			
DEFINITION OF REENGINEERING			
Importance of 3Cs-customers takes charges, competition intensifies, and change becomes constant , Definition of Business Process Reengineering fundamentals rethinking, radical redesign, and dramatic improvement Rethinking business process, new world of and enabling role of information technology			
QUALITY MANAGEMENT SYSTEMS			
ISO 9000-2000, IS 14000, Frame Work for Business Excellence - Malcolm Baldrige Award, Deming's Award			
Module-5			
SIX SIGMA			
The Basics, The core of Six Sigma(DMAIC), design for Six Sigma, DFSS and the customer, Quality time and the Bottom line , core of DFSS-IDOV method , DFSS Metrics, DFSS Infrastructure People and resources, Implementing DFSS			
ACTIVITY BASED MANAGEMENT (ABM)			
Introduction, Traditional Cost Systems, Activity Based activity Based Costing, Activity Based Management, ABM Implementation, Case Study.			
Course Outcomes: After the completion of the course, a student will			
<ol style="list-style-type: none"> 1. Have a understanding of the need for learning the world class manufacturing setup. 2. Learn the principles and practices of world class manufacturing. 3. Determine the quality practices as applied to world class product and Standard practices of quality of conformance systems. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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.

Text Books:

1. **World Class Manufacturing- A Strategic Perspective** – Sahay B S, Saxena K B C, Ashish Kumar – MacMillan India Ltd – ISBN 0333-93-4741. (unit 1 & 2)
2. **Finding and Implementing Best Practices- Business Process Benchmarking** -Champ, Robert C. – Vision Books, New Delhi – 2008.(unit 3 & 4)
3. **Reengineering the corporation – A Manifesto for Business revolution** – Hammer, Michael and James Champy – Nicholas Brealey Publishing , London.- 1993(unit 5 & 6)
4. **Six sigma for Managers-** Greg Brue – TMH – ISBN- 0-07-048639- 5 -2002.(unit 7)

Reference Books:

1. **Design for Six Sigma** –Grege – TMH – ISBN 0-07-058120. – 2003.
2. **Design for Six Sigma Technology and Product Development** – Creveling -Pearson Education – 2008.
3. **Total Quality Management** -Dale H. Besterfield, carol Besterfield- Minchna, glen H Besterfield and Mary Besterfield scare – Pearson education – 3rd edition – ISBN 81-297-0260-6 (Part of Unit 6)
4. **Total Quality Management** – Kesavan R – I K International Publishing house Pvt. Ltd –

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
MAINTENANCE AND SAFETY ENGINEERING			
Course Code	18IM744	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Credits – 03			
Course Learning Objectives: To provide the students with			
<ul style="list-style-type: none"> • Understand the mechanics of safety • Understand different types of maintenance and different type of models • Quality , Reliability and Maintainability of safety and maintenance 			
Module-1			
Introduction, Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st Century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions. Maintenance Management and Control: Maintenance Manual, Maintenance, Facility Evaluation, Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control Indices.			
Module-2			
Types Of Maintenance: Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program PM Program Evaluation and Improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models. Inventory Control In Maintenance: Inventory Control Objectives and Basic Inventory Decisions, ABC Inventory Control Method, Inventory Control Models Two-Bin Inventory Control and Safety Stock, Spares Determination Factors Spares Calculation Methods			
Module-3			
Quality And Safety In Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to Improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers. Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and Steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.			
Module-4			
Reliability, Reliability Centered Maintenance, Rcm: Goals And Principles, RCM Process and Associated Questions, RCM Program Components Effectiveness Measurement Indicators, RCM Benefits and Reasons for Its Failures, Reliability Versus Maintenance and Reliability in Support Phase, Bathtub Hazard Rate Concept, Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.			
Module-5			
Maintainability: Maintainability Importance and Objective, Maintainability in Systems LifeCycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.			
Course Outcomes: After the completion of the course, a student will			
<ul style="list-style-type: none"> • Understand the content of essential concepts in system safety and systems engineering. • Be able to develop advanced risk models to be used for dynamic risk control and with integrated machine learning. • Develop safety and/or maintenance indicators for controlling operational safety 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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. 			
Text Books:			
<ul style="list-style-type: none"> • Reliability, Maintenance and Safety Engineering/ Dr. A. K. Gupta/ Laxmi Publications. 			

- Industrial Safety Management/ L.M. Deshmukh/TMH

Reference Books:

- Maintenance Engineering & Management / R. C. Mishra/ PHI
- Reliability Engineering / Elsayed/ Pearson
- Engineering Maintenance a modern approach/ B.S Dhallon/ C.R.R Publishers
- A Text Book of Reliability and Maintenance Engineering/Alakesh Manna/IK International Publishing House
- Plant Maintenance and Reliability Engineering/NVS Raju/Cengage Learning

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
HUMAN RESOURCE MANAGEMENT			
Course Code	18IM751	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. Recognize the importance of Human Resource in an organization. 2. Explain the importance of Recruitment and Training in staffing an organization. 3. Recognize the training and development needs and identify the training methods. 4. Use special methods to enhance HR systems. 5. Identify the importance of industrial relations and industrial disputes and settlement 			
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: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Recall and explain the importance of HR in an organization • Demonstrate skills in identifying the right man for the right job and carry out scientific selection. • Interpret the training requirement and use the right method of training. • Employ the right techniques for employee performance enhancement. • Appraise the importance of industrial relations and correlate the existing legislations to settlement of industrial disputes. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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	Human Resources Management	Dr. K Ashwathappa	Tata McGraw Hill	1999.
2	Management of Human Resources	CB Mamoria	Himalaya Publication House	2003.
Reference Books				
3	Personnel / Human Resource Management	Decenzo and Robbins	PHI	2002
4	Human Resources Management	VSP Rao		
5	Industrial Relations	Arun Monappa	TMH - ISBN – 0-07-451710-8.	

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
ORGANIZATIONAL BEHAVIOR			
Course Code	18IM752	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. To make students understand fundamental concepts and principles of management, including the basic roles, skills, and functions of management. 2. To make students knowledgeable of historical development, theoretical aspects and practice application of managerial process. 3. To understand the basic concepts and theories underlying individual behaviour besides developing better insights into one's own self. 4. To make students aware of Individual behaviour in groups, dynamics of groups and team building besides developing a better awareness of how they can be better facilitators for building effective teams as leaders themselves. 			
Module-1			
Introduction: Definition of Organization Behaviour and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems).			
Foundations of individual behavior: individual differences. Ability: Intellectual abilities, Physical ability, the role of disabilities. Attitude: Meaning, Formation, components of attitudes, relation between attitude and behavior, Aptitude, interests. Values.			
Module-2			
Personality: Meaning, formation, determinants, traits of personality, big five and MBTI, personality attributes influencing OB. Personality Job Fit Theory.			
Learning: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement.			
Module-3			
Perception: Meaning, Process of perception, factors influencing perception, link between perception and individual decision-making.			
Module-4			
Motivation: Maslow's Hierarchy of Needs theory, Mc-Gregor's theory X and Y, Hertzberg's motivation Hygiene theory, David Mc-Clelland's three needs theory, Victor Vroom's expectancy theory of motivation.			
Leadership: Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories.			
Module-5			
Group Behavior: Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making.			
Course Outcomes: At the end of the course the student will be able to:			
<ol style="list-style-type: none"> 1. Demonstrate their conceptual skills understanding and application of principles and functions of management and to enable students basic understanding of dynamics of OB 2. Evaluate the global context for taking managerial actions of planning, Organizing and Controlling and application of concepts of planning like MBO and Managerial decision making. 3. The Student will demonstrate ability to analyze predicting and to control behaviour of people at work for organization effectiveness. 4. Students to develop leadership skills and ability to motivate and work in groups to achieve organizational goals. 5. Understand and demonstrate their exposure towards growing complexities and recent trends in management. 			
Question paper pattern:			
<ul style="list-style-type: none"> • 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	Organizational Behaviour	Stephen P Robbins, Timothy A. Judge, SeemaSanghi	-Pearson Education	14th Edition, 2012
2	Organization Behaviour	Ashwathappa,	Himalaya Publication House	
Reference Books				
3	Organizational Behavior	Fred Luthans	Tata Mc Graw HILL	
4	Organizational Behavior.	PG Aquinas	Excel Books	

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VII				
SUPPLY CHAIN MANAGEMENT				
Course Code	18IM753	CIE Marks	40	
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60	
Credits	03	Exam Hours	03	
Course Learning Objectives: <ol style="list-style-type: none"> 1. Identify the different elements of a Strategic Framework and analyse supply chains. 2. Explain the elements in the design of supply chain networks. 3. Demonstrate the facilities location for designing the supply chain network 4. Determine the inventories for supply chains. 5. Recognize emerging concepts for supply chain networks 				
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.				
Module-2 DESIGNING THE SUPPLY CHAIN NETWORK: Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.				
Module-3 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.				
Module-4 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-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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 & Operation	Sunil Chopra & Peter Meindl	Pearson Education Asia - ISBN: 81-7808-272-1	2001.
2	Supply Chain Redesign – Transforming Supply Chains	Robert B Handfield,	Pearson Education Inc - ISBN: 81-297-0113-8	2002

Reference Books				
3	Supply Chain and Logistics Management	Upendra Kachuru		
4	Modelling the Supply Chain	Jeremy F Shapiro,	Thomson Learning ISBN 0-534-37363	2002.
5	Designing & Managing the Supply Chain	David Simchi Levi, Philip Kaminsky & Edith Simchi	McGraw Hill	

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VII			
ENTERPRISE RESOURCE PLANNING LAB			
Course Code	18IML77	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
Experiments:			
PART – A			
<ol style="list-style-type: none"> 1. Process of customer orders under seasonal / unseasonable and Blanket orders. 2. Generating Bill of Materials for Various Engineering Designs 3. Creating Item Master for various Engineering Designs 4. Conduction of vendor Evaluation exercise 5. Basic Statistical Analysis 6. Creating Purchase order for Items 7. Creating Work order for Items 8. Perform inventory transaction 			
PART – B			
<ol style="list-style-type: none"> 1. Creating quotation process for Items 2. Creating Dispatch Instruction for Items 3. Creating Payment reconciliation. 4. MRP - II Generating of Various reports for confirmed orders 5. Basic statistical analysis 6. Analyse of existing capacity and defining routes optimizing the resources along routes. 7. Optimization problems using OR packages (two exercises only). 8. Scheduling of activities 			
Suggested Software Packages			
<ol style="list-style-type: none"> 1. Statistical Packages : SYSTAT / MINITAB / SPSS and such others 2. ERP Packages: SIXTH SENSE / RAMCO / MAARSMAN / CIMAS / UNISOFT / OPTIMIIZER 10.6 and such others. 3. Preactor – Scheduling Software OR Packages : Lindo / Lingo / STORM / such others 			
Course Outcomes:			
<ul style="list-style-type: none"> • Use the modern software tools in ERP, Statistics and optimization. • Demonstrate the use of appropriate software tools for decision making in business. • Analyze and model the given scenario. • Formulate the problems and solve it using the software tools. 			
From part A one question: 30 Marks			
From part B one question: 50 Marks			
Viva –Voice : 20 Marks			
Total : 100 Marks			

B.E INDUSTRIAL ENGINEERING & MANAGEMENT			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – VII(18IMP78)			
INTERNSHIP			
<p>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.</p>			
Course Code	Refer to VIII semester scheme	CIE Marks	40
Duration of internship	04 weeks	SEE Marks	60
Credit	02	Exam Hours/ Batch	03
<p>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,</p> <ul style="list-style-type: none"> • 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. 			
<p>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</p> <ul style="list-style-type: none"> • 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. <p>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. □</p>			
<p>Course Outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • 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. □ 			
<p>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 faculties 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. □</p> <p>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. □</p>			

B. E. Industrial Engineering & Management Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VIII																													
SUPPLY CHAIN MANAGEMENT																													
Course Code	18IM81	CIE Marks	40																										
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60																										
Credits	03	Exam Hours	03																										
Course Learning Objectives: <ol style="list-style-type: none"> 6. Identify the different elements of a Strategic Framework and analyse supply chains. 7. Explain the elements in the design of supply chain networks. 8. Demonstrate the facilities location for designing the supply chain network 9. Determine the inventories for supply chains. 10. Recognize emerging concepts for supply chain networks 																													
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.																													
Module-2																													
DESIGNING THE SUPPLY CHAIN NETWORK: Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.																													
Module-3																													
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.																													
Module-4																													
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-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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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. 																													
<table border="1"> <thead> <tr> <th>Sl No</th> <th>Title of the Book</th> <th>Name of the Author/s</th> <th>Name of the Publisher</th> <th>Edition and Year</th> </tr> </thead> <tbody> <tr> <td colspan="5">Textbook/s</td> </tr> <tr> <td>1</td> <td>Supply Chain Management – Strategy, Planning & Operation</td> <td>Sunil Chopra & Peter Meindl</td> <td>Pearson Education Asia - ISBN: 81-7808-272-1</td> <td>2001.</td> </tr> <tr> <td>2</td> <td>Supply Chain Redesign – Transforming Supply Chains</td> <td>Robert B Handfield,</td> <td>Pearson Education Inc - ISBN: 81-297-0113-8</td> <td>2002</td> </tr> <tr> <td colspan="5">Reference Books</td> </tr> </tbody> </table>					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 & Operation	Sunil Chopra & Peter Meindl	Pearson Education Asia - ISBN: 81-7808-272-1	2001.	2	Supply Chain Redesign – Transforming Supply Chains	Robert B Handfield,	Pearson Education Inc - ISBN: 81-297-0113-8	2002	Reference Books				
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3	Supply Chain and Logistics Management	Upendra Kachuru		
4	Modelling the Supply Chain	Jeremy F Shapiro,	Thomson Learning ISBN 0-534-37363	2002.
5	Designing & Managing the Supply Chain	David Simchi Levi, Philip Kaminsky & Edith Simchi	McGraw Hill	

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VIII			
AUTOMATION IN MANUFACTURING			
Course Code	18IM821	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • 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: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Explain the basics of productions, automation system and manufacturing operations. Solve the simple problems on mathematical model. • 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. 			
Text Books:			
1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 3rd Edition, 2009, PHI Learning.			
2. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 1999, Prentice-Hall of India.			
3. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata Mc Graw Hill.			
4. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker			

5. "Understanding Additive Manufacturing", Andreas Gebhardt, Hanser Publishers, 2011

Reference Books:

1. Systems Approach to Computer-Integrated Design and Manufacturing by Dr. Nanua Singh, Wiley, 1996.
2. CAD/CAM/CIM P. Radhakrishnan, S. Subramanyan, U. Raju, New Age International Publication Revised Third Edition 2007.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VIII			
LEAN MANUFACTURING			
Course Code	18IM822	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
1. To enable students to design a globally competitive manufacturing organization using lean manufacturing principles;			
2. To develop the skills to implement lean manufacturing in industry and manage the change process to achieve continuous improvement of efficiency and productivity.			
Module-1			
Framework of Toyota Production System: Just in time production system. JIT Logic -Pull system Japanese approach to production elimination of waste - JIT implementation requirements JIT application for job shops, Case studies.			
Adaptable Kanban System: Kanban rules, supplier Kanban and sequence schedule used by supplier, Monthly information & daily information.			
Text Book 1 : Chapter 1- Chapter 2			
Additional Interests: Prepare Kanban Chart for a manufacturing plant			
Module-2			
The rise of mass production: The rise & fall of Mass Production Mass production, work force, organization, tools, product –logical limits of Mass production, Sloan as a necessary compliment to Ford. Case study:- Rouge Production Plant.			
The rise of lean production: - Birth place, concrete example, company as community, Final assembly plant, product development and engineering			
Text Book 2 : Chapter 2			
Additional Interests: List out Lean Management Concepts. And Frame Work of Lean Manufacturing			
Module-3			
Reduction of setup times- Concepts and Techniques: Setup Concepts, practical procedures for reducing setup time.			
Standardization of operations: Machine layout, multi-function workers and job rotation. Improvement activities to reduce work force and increase worker morale -foundation for improvements			
Text Book 1 : Chapter 8, Chapter 9, Chapter 10, Chapter 11, Chapter 12			
Additional Interests: Use any lean Six Sigma Statistical Analysis tool and learn to analyze data using 7QC tools.			
Module-4			
House of Lean -5S's and Waste Walks, Visual Management, Value Stream Mapping-Understanding the current state and designing the future state			
Managing lean enterprise: - Finance, Career ladders, geographic spread and advantages of global enterprise.			
Additional Interests: Develop VSM Current and Future state diagram using Microsoft Visio or Similar Software Package.			
Module-5			
Six sigma concepts: History, definitions, Statistical definitions, quality levels, Technical aspects, Six sigma for all: benefits to organizations, customers, suppliers and employers, Design for Six Sigma, DMAIC principles, DMADV principles, merits and demerits.			
Text Book 5			
Additional Interests: Suggested to read The Certified Six Sigma Green Belt Handbook by Roderick A. Munro and Govindarajan Ramu (ISBN-10: 0873898915)			
Course Outcomes:			
<ul style="list-style-type: none"> • Identify how a production line can be run efficiently • Reflect upon the critical skills and evaluate their own performance • Relate concepts such as 'Just in Time manufacturing' and 'Lean manufacturing to the context of an assembly line. 			
Text Books:			
1: Toyota Production System -An integrated approach to Just in Time - Yasuhiro Monden, - Engineering and Management Press -Institute of Industrial Engineers – 1983.			
2: James P Womack, Daniel T Jones, and Daniel Roos, "The Machine that changed the World. The Story of Lean			

Production –Harper Perennial edition published 1991.

3: Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy, Second Edition Hardcover – 2012by Masaaki Imai

4 :Value Stream Mapping : How to Visualize Work and Align Leadership for Organizational Transformation Paperback – 2016 by Karen Martin , Mike Osterling

5: Lean And Six Sigma - Six Sigma Black Belt (2007 BOK): Enterprise-Wide Deployment Paper Back by Suvabrata Mitra

Reference Books:

Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA 1st Editionby Mike Rother and John Shook

Getting the Right Things Done: A Leader's Guide to Planning and Execution by Dennis, Pascal (January 1, 2006) by Pascal Dennis

The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer by Jeffrey K. Liker

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VIII			
TOTAL QUALITY MANAGEMENT			
Course Code	18IM823	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	03	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • Develop an understanding on the necessary information and skills needed to manage, control and improve quality practices in the organizations through TQM philosophy. • Explain the four revolutions in management thought processes. • Apply the reactive and proactive improvement methodologies for problem solving in organizations. • Demonstrate the importance of team work in problem solving processes. • Define the business excellence models implemented in various organizations. 			
Module-1			
OVERVIEW OF TOTAL QUALITY MANAGEMENT: History of TQM. Axioms of TQM, contributions of Quality Gurus – Deming’s approach, Juran, quality trilogy, Crosby and quality treatment, Imai’s Kaizen, Ishikawa; companywide quality control and Fegenbaum theory of TQC, QFD.			
Module-2			
EVOLUTION OF QUALITY CONCEPTS AND METHODS: Quality concepts. Development of four fitness’s, evolution of methodology, evolution of company integration, quality of conformance versus quality of design from deviations to weaknesses to opportunities. Future fitness’			
FOUR REVOLUTIONS in management thinking and four levels of practice			
Module-3			
Focus on customers: Change in work concept, market-in, and customers.			
Continuous Improvement: Improvement as problem solving process: Management by process, WV model of continuous improvement.			
Reactive Improvement: Identifying the problem, standard steps, seven steps case study, and General guidelines for managers diagnosing a QI story.			
Proactive Improvement: Introduction to proactive improvement, standard steps for proactive improvement, semantics example-customer visitation, Seven Management and Planning Tools.			
Module-4			
Total Participation; Teamwork skill, Dual function of work, teams and teamwork, principles for activating teamwork, creativity in team processes, Initiation strategies, CEO involvement. Strategies for TQM introduction. Infrastructure for mobilization. Phase-in.			
Hoshin Management: Definition, Concepts, Phases in Hoshin Management – overview.			
Societal Networking: Networking and societal diffusion, infrastructure for networking. TQM as learning system, a TQM model for skill development.			
Module-5			
Introduction to Six Sigma: Benefits, fundamentals, Assessing readiness for Six Sigma, five key players, Planning for the Six Sigma initiative. Case discussions.			
Metrics for Six Sigma: The critical-to-quality concept, criteria to metrics, universal standard, baselines, benchmarking, guidelines for metrics.			
Design for Six Sigma: Overview of DFSS, DMADV Method.			
Course Outcome:			
<ul style="list-style-type: none"> • Develop the understanding on TQM concepts. • Make use of quality concepts and four levels of practices to solve the quality related issues • Recommend appropriate revolutions in management thinking for continuous improvement • Design and implement TQM & Six Sigma projects in organizational situations. 			
TEXT BOOKS:			
<ol style="list-style-type: none"> 1. A New American TQM Four Practical Revolutions in Management - Shoji Shiba, Alan Graham and David Walden – Productivity Press, Portlans (USA) -1993. 2. Management for Total Quality - N Logothetis- Prentice Hall of India, New Delhi - 1994.(1stChapter) 3. Greg Brue and Rod Howes, Six Sigma, TATA McGraw-Hill Edition 2006, ISBN: 0-07-063468-8 			

REFERENCE BOOK:

1. **The Quality Improvement Hand Book** -Roger C Swanson - Publisher Vanity Books International, New Delhi - 1995.
2. **Total Quality Management** - Kesavan R - I K International Publishing house Pvt. Ltd – 2008.

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VIII			
FINANCIAL MANAGEMENT			
Course Code	18IM824	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ol style="list-style-type: none"> 1. To provide the concepts and foundations of managing finance in business enterprises. 2. To equip students with tools and techniques for managing finance. 3. To orient students regarding financial management practices in Indian companies and Global enterprises. 			
Module-1			
Introduction: Evolution of Financial Management, Goals, Forms of Business. Risk and Required Return: Risk and return relationship, Business risk, financial risk, and risk in portfolio context, expected rate of return, Capital asset pricing model. Capital Budgeting: Risk analysis in Capital Budgeting, Cost of Capital – Debt, Preference Equity forms of capital.			
Module-2			
Capital Structure and Firm Value: Assumption, Definition and approaches, Modigliani and Miller Mode, Capital Structure decisions – EBIT, EPS analysis, ROI, REI analysis and Cash Flow comparative Analysis. Working Capital Management: Factors influencing working capital requirement, determination of operating cycle and working capital.			
Module-3			
Long Term Financing: Raising of finance form primary and secondary markets, Valuation of securities, features of convertibility securities and warrants, SEBI guide lines on capital issues, stock market in India, Venture capital, Initial Public Offering. Merger Acquisition and Restructuring: Reasons, Mechanics, Cost and benefits of a merger, Evolution, terms and purchase of a division, Takeovers, Acquisitions, Portfolio and financial.			
Module-4			
Securities and Portfolio Analysis: Derivatives, Futures Trading, Financial Statement Analysis: Ratio analysis, time series analysis, Du pont analysis, funds flow analysis.			
Module-5			
International Financial Management: World Monitoring system, Foreign Exchange Markets, International Parity Relationships, International Capital budgeting, Financing Foreign Operations, Raising Foreign Currency Finance, Financing Exports, Documents in International Trade. Financial Management in Sick Units: Definition of sickness, Causes of sickness, Symptoms of sickness, Prediction of sickness, Revival of a sick unit.			
Course Outcomes:			
<ol style="list-style-type: none"> 1. Apply the risk analysis in capital budgeting 2. Analyze the various capital structure decisions of the firm 3. Analyze the security and Portfolio of the firm. 4. Understand the international management and able to explain the financial risk at global level. 			
Text Books:			
<ol style="list-style-type: none"> 1. Financial Management Theory and practice – Prasanna Chandra – TMH – ISBN– 007-044501-X, 5th edn. 2. Financial accounting – B.S. Raman – United publication – VoI II 			
Reference Books:			
<ol style="list-style-type: none"> 1. Financial Management Text & Problems – Khan & Jain – TMH – ISBN 0—07-460208-X. 2. Financial management – IM Pandey – Vikas Pub. House – ISBN 0- 7069-5435-1. 			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VIII			
PROJECT WORK PHASE -II			
Course Code	18IMP83	CIE Marks	40
Contact Hours/Week	02	SEE Marks	60
Credits	08	Exam Hours/Batch	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • 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:			
<ul style="list-style-type: none"> • 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. ■			

B. E. Industrial Engineering & Management			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VIII			
TECHNICAL SEMINAR			
Course Code	18IMS84	CIE Marks	100
Contact Hours/Week	02	SEE Marks	--
Credits	01	Exam Hours	--
Course Learning Objectives:			
<p>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.</p> <p>Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.</p> <ul style="list-style-type: none"> • 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. <p>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. □</p>			
Course Outcomes:			
<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • 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. □ 			
Graduate Attributes (As per NBA):			
<p>Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			
Evaluation Procedure:			
<p>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.</p> <p>Marks distribution for CIE of the course: Seminar Report:50 marks Presentation skill:25 marks Question and Answer: 25 marks. □</p>			