SELF ASSESSMENT REPORT (SAR)

FOR ACCREDITATION OF UG ENGINEERING (Mechanical) PROGRAMME (TIER-II)

Submitted to

NATIONAL BOARD OF ACCREDITATION
New Delhi

AMAL JYOTHI COLLEGE OF ENGINEERING
Koovappally P. O., Kanjirappally
Kottayam Dst., Kerala

SEPTEMBER 2015

Contents

Self – Assessment Report (SAR)

Part A

I. Institutional Information

I.1.Name and address of the institution and affiliating university:

(Instruction: The name, address of the institution, and the name of the university which has given affiliation to this institution, are to be listed here.)

Amal Jyothi College of Engineering
Koovappally P.O., Kanjirappally,
Kottayam Dst., Kerala.
PIN 686518
Affiliating University: **Mahatma Gandhi University, Kottayam 686560/ Kerala Technological University, Trivandrum, Kerala.**
Senior three batches are affiliated to Mahatma Gandhi University and the current first year batch (2015-16) to Kerala Technological University.

I.2. Name, designation, telephone number, and email address of the contact person for the NBA:

(Instruction: The name of the contact person, with other details, has to be listed here.)

Rev. Fr. Dr. Jose Kannampuzha
Principal
Telephones: 04282-305503; R: 048282-51136; M: 09447870275
E-Mail: *principal@amaljyothi.ac.in*

I.3. History of the institution *(including the date of introduction and number of seats of various programmes of study along with the NBA accreditation, if any) in tabular form:*

(Instruction: History of the institution and its chronological development along with the records of past accreditation need to be listed here.)

Year	Description
2001	Institution established with the following programmes (intake) B. Tech. Computer Science and Engineering (45) B. Tech. Electrical and Electronics Engineering (45) B. Tech. Information Technology (45) B. Tech. Electronics and Communication Engineering (45)
2002	Intake of B. Tech. CSE increased (60) Intake of B. Tech. EEE increased (60) Intake of B. Tech. IT increased (60) Intake of B. Tech. ECE increased (60)
2004	Intake of B. Tech. ECE increased (90)
2005	Started B. Tech. in Mechanical Engineering (60)
2006	Started B. Tech Civil Engineering (60) Intake of B. Tech. ECE increased (120)
2008	NBA accreditation visits and accreditation for B. Tech. Electronics and Communication Engineering, and B. Tech. Electrical and Electronics Engineering Started MCA Programme (60) Started M. Tech. Communication Engg (18)
2009	Intake of B. Tech. CSE increased (90) Intake of B. Tech. ME increased (90)

2010	Started B. Tech. Automobile Engineering (60) M. Tech. Machine Design (18) M. Tech. Communication Engineering (24) M. Tech. in Power Electronics & Power systems (18) MCA lateral entry (60)
2011	Started M. Tech. Computer Science (18) Intake of B. Tech. Mechanical Engineering increased (120)
2012	Started B. Tech. Metallurgy (60) M. Tech. (Civil) Structural Engg & Construction Management (24) M. Tech. (Civil) Computer aided structural design (24)
2013	Started B. Tech. Chemical Engineering (60) M. Tech. Energy Systems (18) Intake of B. Tech. CSE increased (120) Intake of M. Tech. CSE increased (24)
2014	Started MCA Dual Degree (60)
2015	Started M. Tech. in Nanotechnology (24)

I.4. Ownership status: *Govt. (central/state) / trust/ society (Govt./NGO/Private)/Private/ other:*

(Instruction: Ownership status of the institute has to be listed here.)

Private
Managed by the Catholic Diocese of Kanjirappally, Kottayam, Kerala

I.5. Mission and Vision of the Institution:

(The institution needs to specify its Mission and Vision).

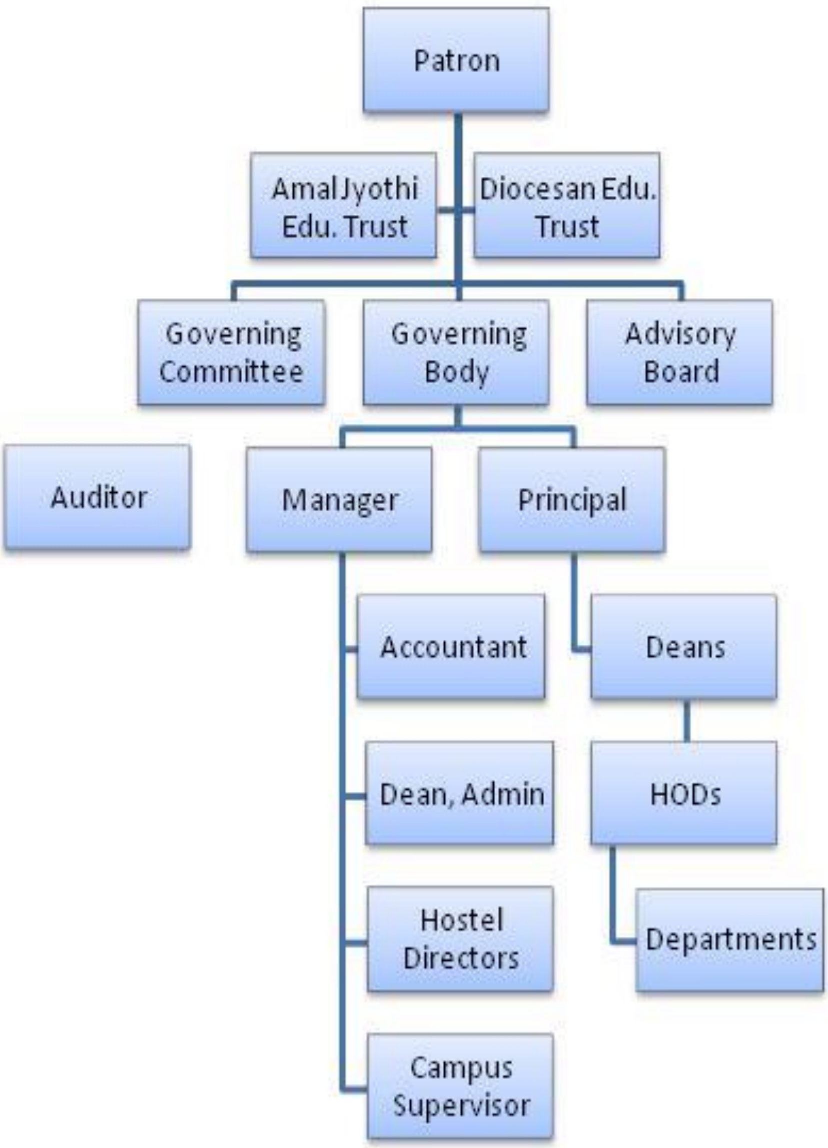
Vision
To be a center of excellence in technical higher education, research and support services, capable of making significant contribution to individual and societal empowerment.

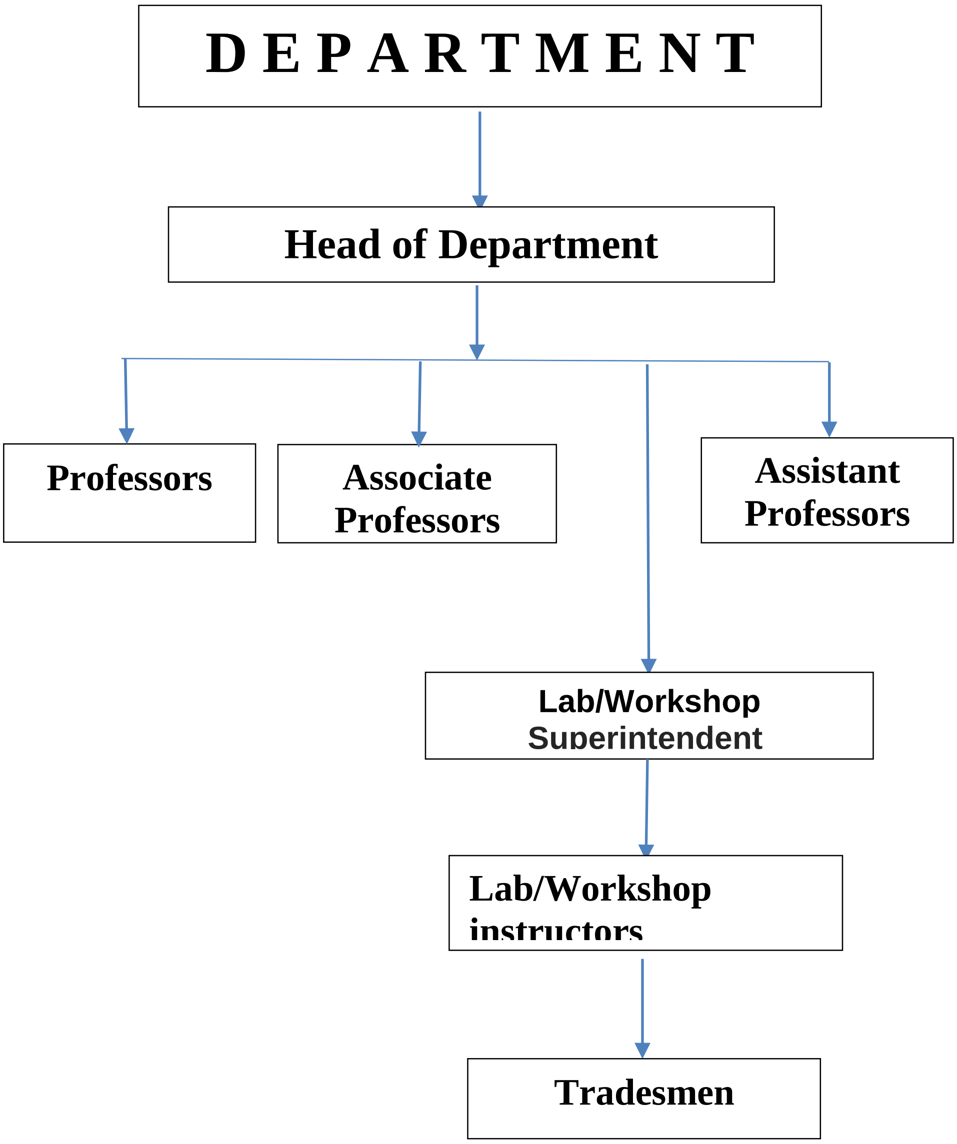
Mission
To create technically qualified world-class professionals with social commitment through Career- oriented courses conducted by high profile faculties, complemented with globally Interactive learning processes and leading edge technology.

I.6.OrganizationalStructure:

(Organizational chart showing the hierarchy of academia and administration to be included)

ORGANISATION STRUCTURE OF AJCE





I.7. Financial status: *Govt. (central/state)/grants-in-aid/not-for-profit / private self-financing / other:*

(Instruction: Financial status of the institute has to be mentioned here.)

Private self-financing

I.8.Nature of the trust/society:

(Instruction: Way of functioning and activities of the trust/society have to be listed here.)

Diocesan Educational Trust, Kanjirapally having its office at Pastoral Centre, Kanjirappally, Kanjirappally Panchayathu, Ward IV, Building No.533 is the promoting body of the institution. The deed of the trust is made on 6th September, 2000 and registered under # 254 /2000 /4. The trust is promoted by the catholic diocese of Kanjirappally, a religious institution of the catholic denomination, which is a minority community, engaged in charitable activities for the benefit of the public, irrespective of caste, creed and community.

Also, list other institutions/colleges run by the trust/society

Amal Jyothi College of Engineering, Kanjirappally is the only institution under this Trust.

I.9.External sources of funds:

(Instruction: The different sources of the external funds over the last three financial years are to be listed here.)

(Amounts in Lakhs of Rs.)

Name of the external source	CFY up to 31-12-2014	CFY*m*1 2013-14	CFY*m*2 2012-13	CFYm3 2011-12
Loan from Banks	3551	3235	2129	1399

I.10. Internally acquired funds:

(Instruction: The different sources of the internal funds over the last three financial years are to be listed here.)

(Amounts in Lakhs of Rs.)

Name of the internal source	CFY up to 31-12-2014	CFY*m*1 2013-14	CFY*m*2 2012-13	CFYm3 2011-12
Students' fee	2387	2643	2260	1804
Refundable deposit	532	522	513	498

I.11 Were scholarships or any other financial assistance provided to students?

(Instruction: If any scholarship or financial assistance has been provided to the students, then the detail of such assistance, over the last three financial years, has to be listed here. Also, mention the basis for the award of such scholarship).

The scholarships available to students are listed below.

(All amounts in Lakhs of Rs.)

Name /Nature of scholarship		CFYm3 2011-2012		CFYm2 2012-2013		CFYm1 2013-2014		CFY 2014-15	
		Nos	Amt	Nos	Amt	Nos	Amt	No.s	Amt
TFW	GOVT.	81	54.51	98	67.26	113	84.75	123	92.25
TFW	MGMT	2	0.75	4	2.00	7	4.625		
AJECS	AJECS	39	6.15	43	11.30	14	4.26	11	0.38
MOMA- MCM	GOVT.	19	5.65	125	34.60	136	39.925		
CSS	GOVT.					8	2.90		
PG-GATE	GOVT. AICTE	11	10.56	30	28.8	45	43.2		
FISHERMEN SCHOLARSHIP	GOVT							1	1.16
AJCE MERIT	MGMT	32	0.48	49	0.49	22	0.22	38	0.45
AJCE MERIT CUM MEANS	MGMT								
CEE-LOW INCOME	MGMT			43	7.97	57	7.56		
VATTAKKUNN EL	EF	4	0.075	4	0.075	4	0.075	4	0.08
LINSA ANNIE	EF	2	0.1	2	0.1	2	0.1	2	0.10
LUKES JOY	EF	2	0.1	2	0.1	2	0.1	2	0.10
BALU S PILLAI	EF			1	0.05	1	0.05	1	0.05
LIZ SIMON	EF								
SILVER ORDINATION	EF							1	0.04
SARAMMA IPE MEMORIAL	EF							1	0.02
RODRIGUES MEMORIAL	EF							1	0.01
VENGAL IPE MEMORIAL	EF							1	0.02
PROF. VIJAYAN’S	EF							1	0.02

TFW: Tuition fee waiver; MOMA: Ministry of Minority Affairs; CSS: Central Sector Scholarships
MGMT: Management; MCM: Merit cum Means; EF: Endowment Fund
Basis of award of all the above scholarships: Merit or Merit cum annual income of parents.

I.12 Basis/criterion for admission to the institution:

(Instruction: The basis/criterion for student intake has to be listed here.)

All India entrance / state-level entrance / university entrance / 12th standard mark sheet/others:

State-level entrance: 50% of the seats are filled from the rank list published by the Commissioner of Entrance Examinations, Government of Kerala. The other 50 % seats under Management quota are filled from the rank list prepared from the applications received by adding the marks scored by the candidates in Plus 2 examination (Mathematics + Physics + Chemistry) and the marks scored by them in the Entrance examination conducted by the Commissioner of Entrance Examinations, Govt. of Kerala.

I.13 Total number of engineering students: *UG (B. Tech.) and PG (M. Tech.)*

(Instruction: Total number of engineering students, both boys and girls, has to be listed here. The data may be categorized in tabular form undergraduate or postgraduate engineering, orother programme, if applicable.)

	CAY	CAY*m*1	CAY*m*2	CAYm3
Total no. of boys:	1612	1516	1350	1187
Total no. of girls:	1157	1160	1119	1040
Total no. of students:	2769	2676	2469	2227

Total number of other students, if any: MCA

MCA Students	CAY 2014-15	CAY*m*1 2013-2014	CAY*m*2 2012-13	CAYm3 2011-12
Total no. of boys:	86	59	61	51
Total no. of girls:	166	108	112	78
Total no. of students:	252*	167	173	129

* 2014-15 MCA includes MCA (Dual Degree), MCA (Lateral Entry) & MCA (Regular)

I.14 Total number of employees

(Instruction: Total number of employees, both men and women, has to be listed here. The data may be categorized in tabular form as teaching and supporting staff.)

Minimum and maximum number of staff on roll in the engineering institution, during the CAY and the previous CAYs (1st July to 30th June):

A. Regular Staff

(Instruction: Staff strength, both teaching and non-teaching, over the last three academic years has to be listed here.)

Items		CAY		CAYm1		CAYm		CAYm3	
		Min	Max	Min	Max	Min	Max	Min	Max
Teaching staff in engineering	M	104	117	116	96	103	100	95	104
	F	81	81	76	68	80	80	69	74
Teaching staff in science & humanities	M	15	14	10	12	13	10	11	13
	F	19	14	17	15	15	14	11	12
Non-teaching staff	M	78	83	81	72	78	73	63	67
	F	18	24	21	18	21	22	23	18

B. Contractual Staff

Items		CAY		CAYm1		CAYm2		CAYm3	
		Min	Max	Min	Max	Min	Max	Min	Max
Teaching staff in engineering	M								
	F								
Teaching staff in science &humanities	M								
	F								
Non-teaching staff	M	4	4	2	4	2	2	2	2
	F								

II. Departmental Information

II.1. Name and address of the department:

DEPARTMENT OF MECHANICAL ENGINEERING
AMAL JYOTHI COLLEGE OF ENGINEERING,

KOOVAPPALLY P.O., KANJIRAPPALLY

KOTTAYAM, KERALA.

PIN: 686518

II.2. Name, designation, telephone number, and e-mail address of the contact person for the NBA:

PROF. SREEKUMAR K

PROFESSOR& HEAD OF THE DEPARTMENT

TELEPHONE NUMBER: 04828 251895, 251661

FAX NO: 04828 251136; E MAIL: ksreekumar@amaljyothi.ac.in

II.3. History of the department including date of introduction and number of seats of various programmes of study along with the NBA accreditation, if any:

Program	Description
UG in Mechanical Engineering	Started with 60 seats in 2004
	Intake increased to 90 in 2009
	Intake increased to 120 in 2011
PG in 1. Machine Design	Started with 18 seats in 2009

II.4 Vision and Mission of the Department

Vision of the Department

To create graduate and post graduate Mechanical engineers having excellence and competence in addressing the needs in the disciplines of Mechanical Engineering and allied areas at both National and International levels with a deep commitment to serving the society for bettering the standard of living.

Mission of the Department

To impart formal education in Mechanical engineering and allied areas at under graduate and post graduate levels by integrating a variety of project experiences at every level throughout the curriculum. They should be able to apply with confidence the knowledge in Mechanical engineering through research in the science and technology. To share knowledge through educational programs and the dissemination of our new discoveries. To develop linkages with world class R&D organizations and educational institutions in India and abroad for excellence in teaching, research, consultancy practices and entrepreneurship.

II.5. List of the programmes/ departments which share human resources and/or the facilities of this department/programme (in %):

Subjects taken for S1 S2 (13 batches)		Hours/ week	Credits
S1 S2 AUE Automobile Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 CH Chemical Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 CSE A Computer Science & Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 CSE B Computer Science & Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 ECE A Electronics & Communication Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 ECE B Electronics & Communication Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 EEE Electrical & Electronics Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 IT Information Technology	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 ME A Mechanical Engineering	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 ME B Mechanical Engineering	EN010 107 Basic Mechanical Engineering.	3	4

S1 S2 MET Metallurgy	EN010 107 Basic Mechanical Engineering.	3	4
S1 S2 AUE Automobile Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 CH Chemical Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 CSE A Computer Science & Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 CSE B Computer Science & Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 ECE A Electronics & Communication Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 ECE B Electronics & Communication Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 EEE Electrical & Electronics Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 IT Information Technology	EN010 105 Engineering Graphics	5	6
S1 S2 ME A Mechanical Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 ME B Mechanical Engineering	EN010 105 Engineering Graphics	5	6
S1 S2 MET Metallurgy	EN010 105 Engineering Graphics	5	6
Subjects taken for S3 EE		Hours/ week	Credit
S3 EE 010 306	Mechanical Technology	4	4
S3 EE 010 308	Mechanical Technology	3	2
Subjects taken for S4 CE		Hours/ week	Credit
CE 010 408	Hydraulics Lab	3	2

II.6. Total number of students: UG: 484

II.7. Minimum and maximum number of staff on roll during the current and three previous academic years (1st July to 30th June) in the department:

Items	CAY (20142015)-		CAY*m*1 (2013-2014)		CAY*m*2 (2012-2013		CAY*m*3 (2011-2012)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Teaching staff in the department	27	31	28	31	26	29	29	29
Non-teaching staff	12	13	12	12	12	12	12	12
Total	40	43	40	43	38	41	41	41

II.7.1. Summary of budget for the CFY and the actual expenditure incurred in the CFYm1, CFYm2 and CFYm3 (for the department): *(All amount in lakhs of rupees.)*

Items	Budgeted in CFY (2014-2015)	Actual expenses in CFY (till December 2014…)	Budgeted in CFY*m*1 2013-'14)	Actual Expenses CFY*m*1 (2013-2014)	Budgeted in CFY*m*2 (12-13)	Actual Expenses in CFY*m*2	Budgeted in CFY*m*3	Actual Expenses in CFY*m*3
Laboratory equipment	15.38	6.86	19.90	0.70	20.73	0.08	26.14	0.45
Software	0	0	8.50	6.06	0	0	0	0
Laboratory consumable	3.00	1.19	3.00	1.72	3.00	1.19	2.77	1.09
Maintenance and spares	0.50	0.19	0.50	0.02	0.50	0.12	0	0.04
Training and Travel	0.80	0.06	0.16	0.09	0.08	0.06	0.10	0.05
Miscellaneous expenses for academic activities	1.50	1.00	0.80	0.75	1.50	0.80	0.11	0.12
Total	**21.18**	**9.30**	**32.86**	**9.34**	**25.81**	**2.25**	**29.12**	**1.75**

III. Programme Specific information

III.1. Name of the Programme

Bachelor of Technology in Mechanical Engineering (B. Tech)

(List name of the programme, as it appears on the graduate's certificate and transcript, and abbreviation used for the programme.)

III.2. Title of the Degree

Bachelor of Technology in Mechanical Engineering *(B. Tech Mechanical Engineering)*

(List name of the degree title, as it appears on the graduate's certificate and transcript, and abbreviation used for the degree.)

III.3. Name, designation, telephone number, and e-mail address of the Programme Coordinator for the NBA:

PROF. SREEKUMAR K

PROFESSOR & HEAD OF THE DEPARTMENT

TELEPHONE NUMBER: 04828 251895, 251661

FAX NO: 04828 251136

E MAIL: *ksreekumar@amaljyothi.ac.in*

III.4. History of the programme along with the NBA accreditation, if any:

Programme	Description
UG in Mechanical Engineering	• Started with 60 seats in 2004
	• Intake increased to 90 in 2009
	• Intake increased to 120 in 2011

III.5. Deficiencies, weaknesses/concerns from previous accreditations: NA

III.6. Total number of students in the programme: **484** (*Boys: 480 Girls: 4*)

III.7.Minimum and maximum number of staff for the current and the three previous academic years (1st July to 30th June) in the programme:

Items	CAY(2014-2015)		CAYm1(2013-2014)		CAYm2(2012-2013		CAYm3	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Teaching staff in the department	27	31	28	31	26	29	29	29
Non-teaching staff	12	13	12	12	12	12	12	12
Total	40	43	40	43	38	41	41	41

III.8. Summary of budget for the CFY and the actual expenditure incurred in CFYm1, CFYm2 and CFYm3 (for this programme in the department exclusively):

(All amounts in Lakhs of Rupees)

Items	Budgeted in CFY	Actual expenses in CFY (till ...)	Budgeted in CFYm1	Actual Expenses in CFYm1	Budgeted in CFYm2	Actual Expenses in CFYm2	Budgeted in CFYm3	Actual Expenses in CFYm3
Laboratory equipment	15.38	6.86	19.90	0.70	20.73	0.08	26.14	0.45
Software	0	0	8.50	6.06	0	0	0	0
Laboratory consumables	3.00	1.19	3.00	1.72	3.00	1.19	2.77	1.09
Maintenance and spares	0.50	0.19	0.50	0.02	0.50	0.12	0	0.04
Travel	0.80	0.06	0.16	0.09	0.08	0.06	0.10	0.05
Miscellaneous expenses for academic activities	1.50	1.00	0.80	0.75	1.50	0.80	0.11	0.12
Total	**21.18**	**9.30**	**32.86**	**9.34**	**25.81**	**2.25**	**29.12**	**1.75**

PART B

1. Vision, Mission and Programme Educational Objectives (75)

(List and articulate the mission and vision statement of the institute and department)

1.1. Vision and Mission (5)

1.1.1. **State the Mission and Vision of the institute and department** (1)

Vision of the college

To be a Centre of excellence in technical higher education, research and support services, capable of making significant contribution to individual and societal empowerment

Vision of the department

To create graduate and post graduate Mechanical engineers having excellence and competence in addressing the needs in the disciplines of Mechanical Engineering and allied areas at both National and International levels with a deep commitment to serving the society for bettering the standard of living.

Mission of the College

To create technically qualified world-class professionals with social commitment through career-oriented courses conducted by high–profile faculty, complemented with globally interactive learning processes and cutting edge technology

Mission of the department

To impart formal education in Mechanical engineering and allied areas at under graduate and post graduate levels by integrating a variety of project experiences at every level throughout the curriculum. They should be able to apply with confidence the knowledge in Mechanical engineering through research in the science and technology. To share knowledge through educational programs and the dissemination of our new discoveries. To develop linkages with world class R&D organizations and educational institutions in India and abroad for excellence in teaching, research, consultancy practices and entrepreneurship.

1.1.2. Indicate how and where the Mission and Vision are published and disseminated (2)

(Describe in which media, e.g. websites, curricula, books, etc. the mission and vision are published and how the same is disseminated among stakeholders)

The vision and mission are published in

- College and department web pages

  http://www.ajce.in/amal-jyothi/courses/mechanical-engineering/me-vision-mission/

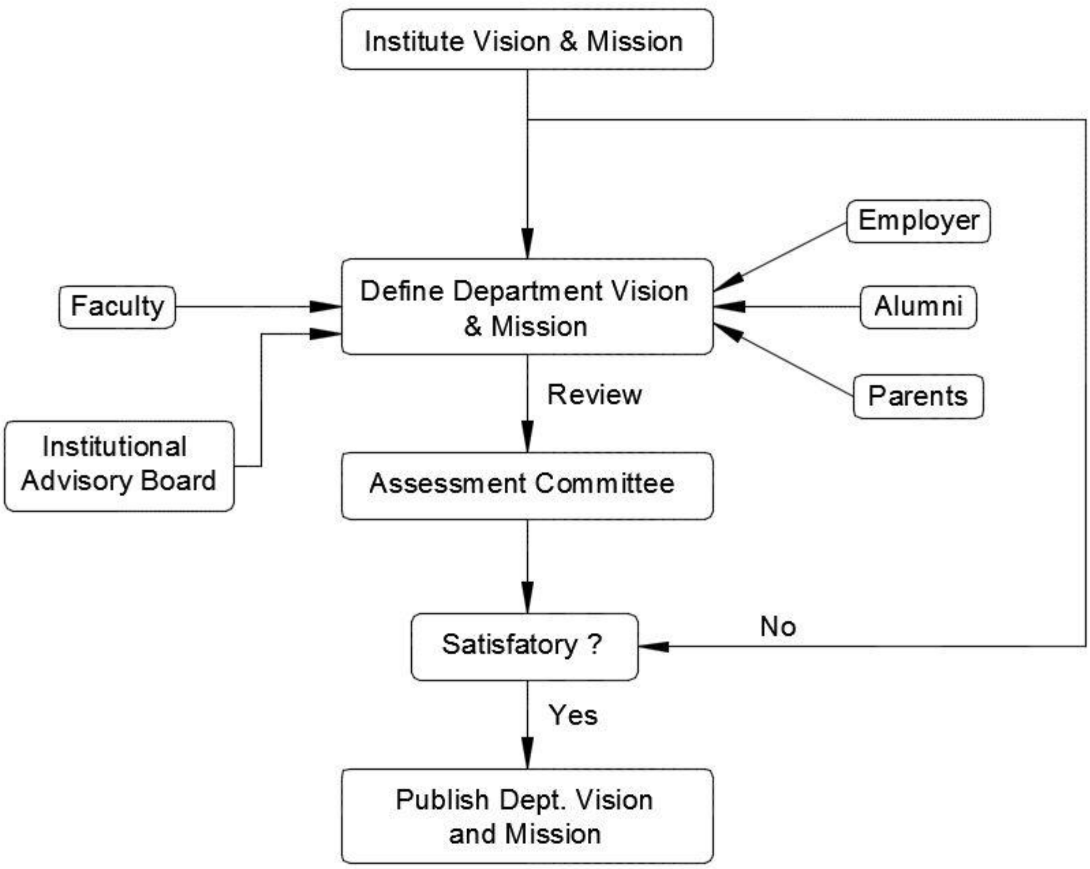
- Academic Calendar
- Display boards in the institution,
- Students Orientation Programmes
- Department news letter

1.1.3. Mention the process for defining the Mission and Vision of the department (2)

(Articulate the process involved in defining the mission and vision of the department from the mission and vision of the institute.)

The vision and mission statements were formulated at the departmental level meetings. Care was taken to ensure that the vision and mission of the department was in sync with the vision and mission of the institute.

The second stage of discussion was held at Academic Council of the institution and positive suggestions were incorporated. The reformulated statements were checked and approved by the advisory committee of the college. This process is as shown in the flowchart below.



1.2. Programme Educational Objectives (15)

1.2.1. Describe the Programme Educational Objectives (PEOs) (2)

(List and articulate the programme educational objectives of the programme under accreditation)

Program Educational Objectives *(PEO)*

To provide the students with:

1. A fundamental understanding of the basic and engineering sciences and develop mathematical and analytical skills required for Mechanical Engineering.

2. Expertise in designing and analyzing various mechanical engineering systems.

3. Ability to provide engineering designs that are based on sound principles considering functionality, aesthetics, safety, cost effectiveness and sustainability.

4. A broad view of the context in which their designs will be implemented and the corresponding impact of these designs on society.

5. Capability to function ethically in professional mechanical engineering roles and exhibit good competency in their work culture.

6. Impetus to take up lifelong learning by being active members of professional bodies like IEI, ASME etc. obtain professional licensure and to undertake higher studies and research activities that will ultimately benefit mankind.

1.2.2. State how and where the PEOs are published and disseminated (2)

(Describe in which media, e.g. websites, curricula, books, etc., the PEOs are published and how the same is disseminated among stakeholders)

1. We communicate our PEOs to the stakeholders especially employers and Alumni through electronic media and meetings.

2. Our PEOs are published on our departmental page on the university website, www.ajce.in.

3. Our PEOs are printed and pasted in department office, department library and laboratories.

1.2.3. List the stakeholders of the programme (1)

(List the stakeholders of the programme under consideration for accreditation and articulate their relevance)

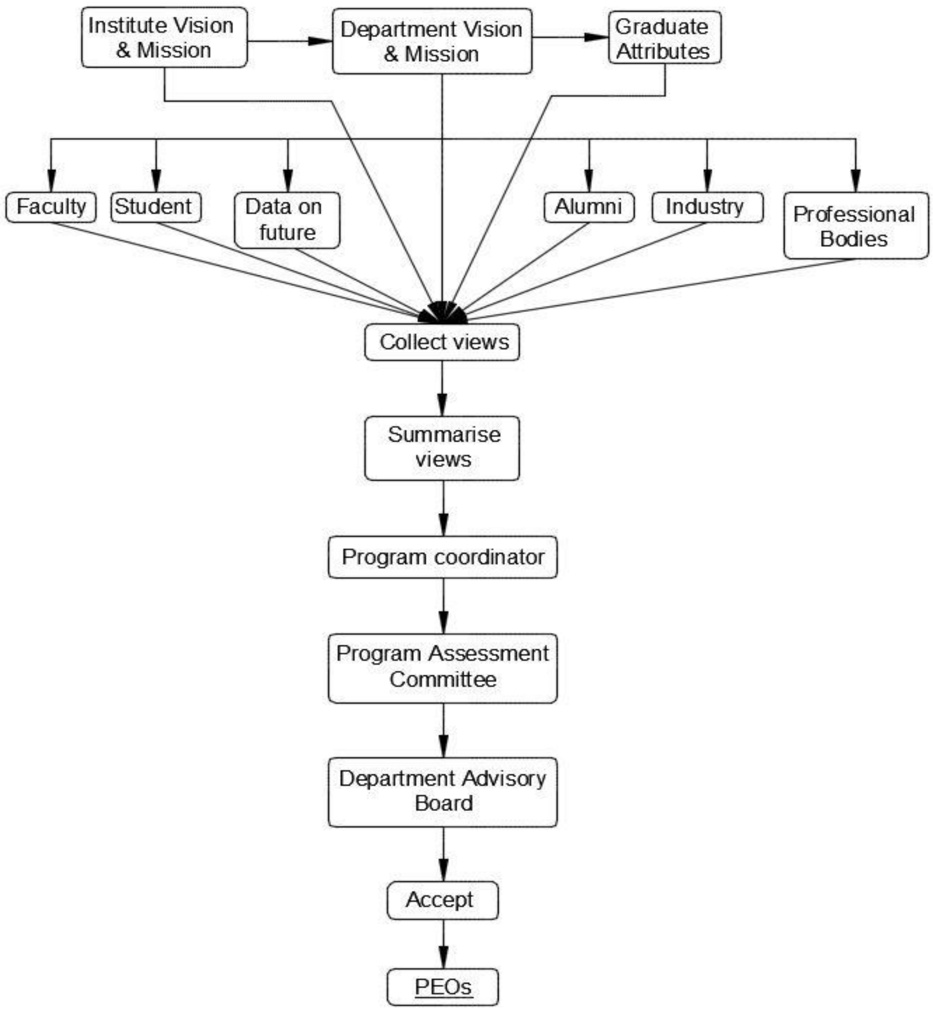
- The Management of AJCE
- Students of ME Department of AJCE.
- Faculty of ME Department of AJCE

- Staff Members of ME Department of AJCE
- Parents
- Alumni
- Advisory committees

1.2.4. State the process for establishing the PEOs (5)

(Describe the process that periodically documents and demonstrates that the PEOs are based on the needs of the various stakeholders of the programme)

- PEO's describe the broad objectives of the programme being offered. The mission of the department has to be accomplished by the attainment of these objectives
- PEOs have been established keeping in mind the changes occurring globally in the field of science, engineering and technology
- The objectives have to be in consonance with the current research scenario as well as the needs of the industry
- Brainstorming among faculty members and student members are held to establish the PEOs



1.2.5. Establish consistency of PEOs with Mission of the institute (5)

(Describe how the Programme Educational Objectives are consistent with the Mission of the department.)

The PEOs and the mission goes hand in hand as it is well evident that the objectives finally aim at the formation of world class engineers with unbeatable technical skills and scientific knowledge firmly based on applications of basic sciences. The PEO's ensure the accomplishments of the mission of the department with special emphasis on value addition and technical competence of engineers, and sustainable solutions to engineering problems.

Mission Component	PEO1	PEO2	PEO3	PEO4	PEO5	PE06
Technical Qualification	X	X	X			
Social Commitment				X	X	
Application of Basic Sciences	X	X	X			X
Interactive learning and Application of Technology	X	X			X	X

1.3. Achievement of Programme Educational Objectives (20)

1.3.1. *Justify the academic factors involved in achievement of the PEOs (5)*

1. Good academics and opportunities to engage in team work (specialized aptitude trainings, placement trainings etc.)
2. Students are encouraged to select topics that have relevance to future research activities for their final year seminar and project works.
3. Social service activities included in the curriculum cultivate good work culture and social commitment in the students.
4. Ample opportunities to participate in international conferences encourage students to become active members of professional bodies.

The achievement of PEOs through curriculum can be identified from the matrix below

	PEO1	PEO2	PEO3	PEO4	PEO5
Core Subjects	x	x	x	x	x
Elective Subjects	x	x	x	x	x
Interdisciplinary Subjects	x	x	x	x	x
Science Subjects				x	x
Humanities and Social Sciences				x	x

1.3.2. Explain how the administrative system helps in ensuring the achievement of the PEOs (5)

(Describe the committees and their functions, working processes and related regulations.)

- Academic council meets twice in every month.
- Departmental meetings are held once in every week.
- PEO review committee meets once in every semester
- The Project evaluation committees are formed at the department level
- Faculty are entrusted with mentorship of group of students to aid their overall development, both curricular and extra-curricular.
- Committees at institute level to ensure proper functioning of the institute
- Course structure is revamped periodically at university level in consultation with various institutions

1.3.3 Indicate the additional co-curricular activities undertaken towards the attainment of the PEOs (10)

- *Industrial visits*

  Industrial visits give the students a firsthand understanding of how big industries work. Industrial visit is mandatory for all students of the department at least once in a year

- *Industrial training*

  Students are encouraged to undergo industrial training during their semester break in some industry of their choice. Also a report has to be submitted at the end of industrial training. Industrial training provides an insight to students about what is happening in the real world and also supplements their class room knowledge

- *Software training program's*

  The advent of various softwares has made life of an engineer easy. So it is essential that students are taught the nuances of various softwares which would help them in giving better shape to their ideas as also give them an added advantage in their career prospects. With this in mind the department has taken a lead in teaching students soft wares like C, AUTO CAD, PRIMAVERA, ANSYS etc.

- *Workshops*

  Different workshops related with curriculum are arranged during academic year to enhance their knowledge in engineering subjects and also students are encouraged to participate in workshops conducted by other colleges

- *Participation in paper presentations and technical competitions at the national and international level*

Students are encouraged to participate in paper presentations and technical competitions at national and international levels.

- *Projects (in three levels):*

  Students have to carry out a project at micro level (second year) where they chose their area of interest. Micro project mainly aims at familiarizing students with literature review and introduction to apply their class room knowledge to research. Mini level projects (third year project) aims at exposing students to real world scenarios of the theory they have studied in class in their area of interest. Main level (final year) project aims at training them to find solutions to real world problems with their technical knowhow. The development of students from micro to mini to main project has been found to be very effective in their growth as engineers.

- *e Learning: online Courses*

  Students are encouraged to use online materials of their courses and also to attend additional online courses to gain knowledge and experience beyond their curriculum

- *Aptitude training*

  Graduate Aptitude Training is given to students during their 3rd and 4th year in order to make them capable of attending all competitive exams, interviews conducted by industries etc.

1.4 Assessment of the achievement of Programme Educational Objectives (25)

1.4.1. Indicate the tools and processes used in assessment of the achievement of the PEOs (15)

Describe the assessment process that periodically documents and demonstrates the degree to which the Programme Educational Objectives have been attained. Also include information on:

a).Listing and description of the assessment processes used to gather data upon which the evaluation of each Programme Educational Objective is based. Examples of data collection processes may include, but are not limited to, employer surveys, graduate surveys, focus groups, industrial advisory committee meetings, or other processes that are relevant and appropriate to the programme; b) The frequency with which these assessment processes are carried out.

Type of Assessment Tool	Assessment Tool	Assessment Criteria	Data Collection Frequency	Responsible Entity	Mapped PEO
Direct	Course Performance	Number of students passed	Once every semester	Department	PEO-1, PEO-2, PEO-3, PEO-4
Indirect	Higher Studies Record	Number of students who opted for higher studies	Once every year	Department	PEO 5 PE0-6
Indirect	GATE Score	Number of students with valid GATE score	Once every year	Department	PEO-1, PEO-2, PEO-3, PEO-4
Indirect	Placement Record	Number of students placed	Once every year	Department	PEO-1, PE0-2, PE0-3, PEO-4, PEO-5, PEO-6
Indirect	Alumni Survey	Level of achievement	Once every year	Department	PEO-1, PE0-2, PEO-3, PE0-4, PEO-5 PEO-6

- Surveys among faculty, students and alumni
  - Frequent survey is conducted among staff, students and alumni of the department to assess the efficiency in the attainment of the PEOs
- Analysis of results in each semester
  - Subject wise and batch wise result analysis is conducted every semester
- Percentage of students going for higher studies
  - Students are encouraged for higher studies , Training for various competitive exams are provided which secures admissions for higher studies with stipend

1.4.2. Provide the evidence of the achievement of the PEOs (10)

a) The expected level of attainment for each of the programme educational objectives;
b) Summaries of the results of the evaluation processes and an analysis illustrating the extent to which each of the Programme Educational Objectives is being attained;
and c) How the results are documented and maintained.

Result Analysis

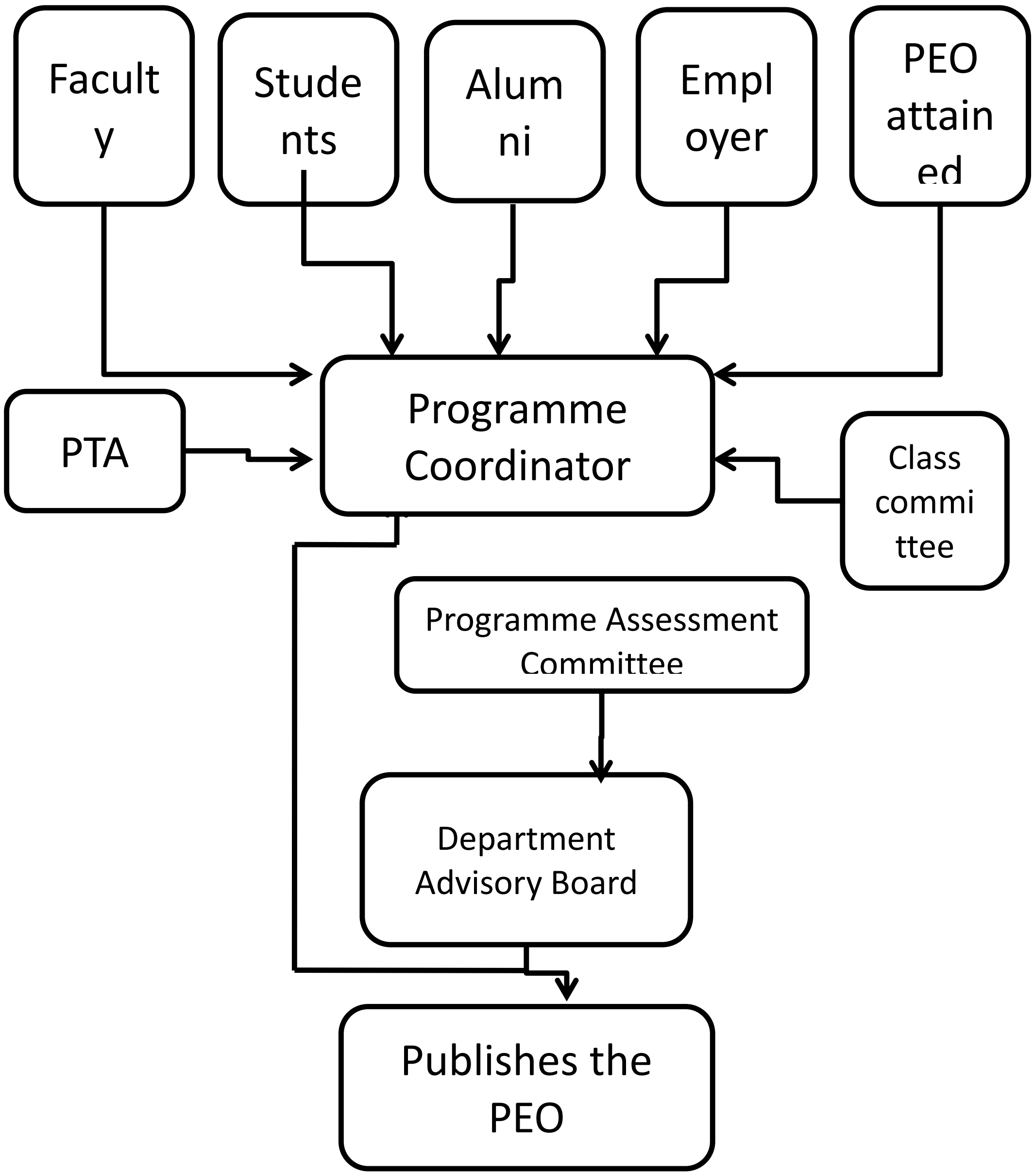
Year of entry (In reverse chronological order)	Number of students in 1st year + admitted via lateral entry in Second year (N1+N2)	Incomplete no of students who have successfully completed			
CAY (2014-2015)	118				
CAYm$_1$(2013-2014)	124	81			
CAYm$_2$(2012-2013)	121	95	86		
CAYm$_3$(2011-2012)	117	68	112	83	
CAY m4(LYG)(2010-2011)	90	64	39	36	41
CAY m4(LYG m1)(2009-2010)	96	62	56	58	55
CAY m4(LYGm2)(2008-2009)	63	31	21	26	30
CAY m5(LYGm2)(2007-2008)	61	39	43	36	46
CAY m4(LYGm2)(2006-2007)	58	15	16	18	26

The results are documented and it is provided in file AJCE/ME/FILE NBA 1)

1.5. Indicate how the PEOs have been redefining in the past (10)

(Articulate, with rationale, how the results of the evaluation of the PEOs have been used to review/redefine the PEOs)

The Programme Educational Objectives of the Mechanical Engineering Department were formulated from the bodies comprising of students and faculty members and there after refined and reformulated by the Academic Council and Members of the Advisory Committee. The PEOs were framed taking into consideration the necessities of the stake holders, vision and mission of the institute and vision and mission of the department. The curriculum set by the university is also in favor of the PEOs of the department. All possible measures are taken for the attainment of the same.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2. Programme Outcomes (150)

2.1. Definition and Validation of Course Outcomes and Programme Outcomes (25)

2.1.1. List the Course Outcomes (COs) and Programme Outcomes (POs) (2)

(List the course outcomes of the courses in programme curriculum and programme outcomes of the programme under accreditation)

Programme outcomes

By the culmination of this programme, the graduate acquires the ability to

1. Analyse, identify and solve engineering problems, through application of knowledge in mathematics, science and engineering to function as good mechanical engineers and lead the people associated with.
2. Identify, formulate and solve engineering problems related to various materials and their properties using skills, techniques and state of art engineering tools.
3. Have good awareness of the trends in design, manufacturing, production and marketing.
4. Apply the mechanical engineering principles to design sound components which can be assembled into systems.
5. Select suitable materials with required properties for the designed components and system.
6. Understand and analyse the thermal and mechanical behaviour of the materials and systems.
7. Identify and apply the most suitable process to manufacture the components.
8. Interpret and use the experimental and field data to make oral / written presentations as required.
9. Understand the ethical requirements of the profession, the need for lifelong learning and the impacts of mechanical engineering activities on society.
10. Manage the job floor of an industry or a research organization efficiently and effectively by the optimized utilization of the resources for the maximum output.

The curriculum for Mechanical Engineering is set by M. G. University Board of Studies. The courses in the curriculum are such that they satisfy all the objectives and outcome defined for the programme.

Course outcomes

EN010 101	Engineering Mathematics I	*On completion of this course a successful candidate will* 1. Develop a fundamental understanding of Matrix, Eigen values, Eigen vectors, diagonalized form of a given matrix and also reduce the quadratic form of a matrix to its canonical form. 2. Understand the application of derivatives in more than one variable and also find the derivatives higher orders. 3. Have a fundamental understanding of double integration, triple integration and visualize the concept of volume in 3-dimensional space. 4. Understand the concept of linear differential equation of the second order and modeling a differential equation from their applications. 5. Find the Laplace transform and its inverse Laplace transform of a function and to solve a differential equation using Laplace transform
EN010 102	Engineering Physics	*On completion of this course a successful candidate will* 1. Find Innovative solutions to real world issues in Physics and Computer Science. 2. To design, fabricate, produce test and supervise the manufacture the complex products and systems for a no. of industries like computer industry. 3. Supervise manufacturing process and oversee installation and maintenance. 4. To work with microprocessors, fibre optics and in telecommunication, television and radio.

		5. To the interdisciplinary aspects of nano science by integrating important components of the broad research field together.
EN010 103	Engineering Chemistry and Environmental Studies	*On completion of this course a successful candidate will* 1. Solve quantitative chemistry problems and demonstrate reasoning clearly and completely. 2. Describe, explain, and model chemical and physical processes at the molecular level in order to explain macroscopic properties. 3. Clearly explain qualitative chemical concepts and trends. 4. Demonstrate an understanding of the impact of engineering solutions in a global and societal context 5. Demonstrate a knowledge of contemporary environmental issues.
EN010 104	Engineering Mechanics	*On completion of this course a successful candidate will* 1. Analyze a system of forces and find the direction of the resultant motion of the particle or body upon which it acts 2. Analyze any system which is in equilibrium by considering each body separately and apply the equilibrium analysis. 3. Analyze any beam, truss or framed structure. 4. Locate the centroid, centre of mass and gravity and moment of inertia of areas and physical bodies. 5. Given a problem in Engineering Dynamics, identify the most appropriate solution technique. 6. Apply equations for straight line motion to solve problems with variable acceleration 7. Solve plane curvilinear motion problems in 3 different coordinate systems. 8. Analyze dynamic problems using work energy and impulse momentum techniques.
EN010 105	Engineering Graphics	*On completion of this course* 1. Students will be able to prepare and understand drawings.

		2. The drawing skills of students will be improved. 3. Students will get an idea about various curves used in Engineering and their applications. 4. Students can understand and use the principles of orthographic projections. 5. By studying about projections of solids students will be able to visualize three dimensional objects and that will enable them to design new products. 6. By studying about the sections of solids students will be able to describe the internal details of objects, machine parts etc. 7. Development of surfaces enables the student to design and fabricate surfaces of different shapes. 8. With a good knowledge in isometric and perspective projections the student will be able to represent the objects in three dimensional appearances. 9. The knowledge of intersection of surfaces helps the students in the applications like pipe fittings, boiler fittings, Automobile body works, air conditioning ducts etc.
EN010 106	Basic Mechanical Engineering	*On completion of this course a* 1. Student will have a general idea on the varieties and cost of construction materials available in the market, their manufacture processes and types. 2. The student will have an understanding on the different parts of buildings and its construction practices making him eligible to analyze a construction work. 3. The students will get the idea about different foundations practically used and about the structural significance of the same 4. The student gets the concepts on surveying and surveying results like maps, remote sensing, GPS, GIS etc.

		5. The basics of transportation engineering, sanitary engineering, building regulations and modern concepts of building construction are known to the students that is of social, environmental relevance
EN010 107	Basic Mechanical Engineering	*On completion of this course* 1. Student becomes interested in the field of mechanical engineering and understands the relevance in industry. 2. By studying the basics the student will be able to appreciate the importance of this subject. 3. Student gets a better idea about automobile. 4. Students gets a better idea about mechanical power transmission equipment. 5. The student will understand the theories behind turbine working and different types of turbine. 6. Students can understand the working of pumps using in day to day life. 7. Students can understand the working of machine tools and manufacturing processes.
EN010 108	Basic Electrical Engineering	*On completion of this course a successful candidate will* 1. Understand basics of electrical networks and methods to solve them. 2. Understand the elementary concepts of electromagnetism and electromagnetic induction. 3. Understand generation of AC voltage and other fundamentals of AC circuits. 4. Understand the working principles of DC and AC machines. 5. Understand the relevance of energy management and Green energy.
EN010 109	Basic Electronics Engineering and	*On completion of this course a successful candidate will* 1. Understand the concepts and components of basic electronics. 2. Understand the consumer applications of communication.

	Information Technology	3. Understand, identify and explain the main components in a basic communication system. 4. Clarify and decide on the type of different transistor configurations. 5. Understand the basic concepts of wireless communication. 6. Identify different modulation techniques. 7. Understand the basic principles of instrumentation. 8. Provide a good understanding of op-amp and its basic ideas. 9. Introduce the concept of different types of transducer. 10. Identify the main component of a computer. 11. Uses of input/output devices of a computer. 12. Differentiate the function of system software and application software.
EN010 110	Mechanical Workshop	*On completion of this course a successful candidate will* 1. Have complete awareness on the functioning of basic mechanical workshops which include, Smithy, Foundry, Carpentry and Fittings
EN010 111	Electrical and Mechanical Workshop	*On completion of this course a successful candidate will* 2. Have complete awareness on the functioning of basic mechanical and electrical works that are involved in day to day lives.
EN010 301	Engineering Mathematics II	*On completion of this course a successful candidate will be able* 1. To do problems related to vector differentiation and have an idea about the physical meaning of divergence and curl. 2. To evaluate line integrals and surface integrals, understand and use the major theorems in vector calculus (the Fundamental Theorem of Line Integral, Green's Theorem, Stokes' Theorem, and the Divergence theorem).
EN010 302	Economics and Communication Skills	*On completion of this course* 1. Understand the structure and functioning of the major financial institutions

		2. Analyze and evaluate the New Economic Policies of the Government of India 3. Get an orientation to Indian Public Finance 4. Understand the fundamentals of National Income Analysis 5. Analyse the problems of inflation and BOP and suggest measures to control them. 6. Have an understanding of the major issues in International Economics
ME010 303	Fluid Mechanics	*On completion of this course* 1. Be able to convert units of any parameter between three systems of units, understand the physical properties and characteristic behavior of fluids, and the basic principles of fluid mechanics. 2. Be able to describe and interpret the behavior and performance of fluid at rest. 3. Be able to describe and interpret the behavior and performance of fluid in motion. 4. Be able to describe the behavior and performance of fluid when the fluid is flowing through the pipe. 5. Be able to derive the dimensions of different fluid parameters. 6. Be able to apply similitude and modelling principles and techniques to solve problems in hydraulics
ME010 304	Metallurgy and Materials science	*On completion of this course a student can* 1. Understand the basic concepts of materials and its properties. 2. Able to describe the behavior and characteristics of materials 3. Able to achieve good in knowledge in heat treatment.
ME010 305	C programming	*On completion of this course a student will be able to*

		1. Understand the basic concepts of operation of a computer, and fundamentals of C Programming. 2. Get a strong foundation in the basics of C-Programming so that students can develop its own functions. 3. Master the knowledge of arrays and strings in real time applications. 4. Get idea about structures and union 5. Identify the importance of files in different applications
ME010 306	Strength of Materials & Structural Engineering	*On completion of this course a student attains* 1. Sketch the shear force and bending moment diagrams for beams with different support conditions and different load conditions. 2. Determine the stresses and strains in the bars with varying sections, tapering sections, composite members etc. 3. Determine the stresses on oblique sections when the direct stresses and shear stresses are given. 4. Analyze both symmetrical and unsymmetrical sections subjected to bending stress. Understand the shear stress distribution for beam sections of different cross-sections. 5. Analyze both solid and hollow shafts subjected to torsion. 6. Solve problems of columns and struts using different methods such as Rankine's formula, Euler's theory.
ME010 307	C programming Lab	*On completion of this course a student can* 1. Understand the basic concepts of operation of a computer, and fundamentals of C Programming. 2. Get a strong foundation in the basics of C-Programming so that students can develop its own functions. 3. Master the knowledge of arrays and strings in real time applications. 4. Get idea about structures and union 5. Identify the importance of files in different applications

ME010 308	Fluid Mechanics Lab I	*On completion of this course a student attains* 1. Be able to convert units of any parameter between three systems of units, understand the physical properties and characteristic behavior of fluids, and the basic principles of fluid mechanics. 2. Be able to describe and interpret the behavior and performance of fluid at rest. 3. Be able to describe and interpret the behavior and performance of fluid in motion.
EN010 401	Engineering Mathematics III	*After taking this course, the student should be able to* 1. Have a fundamental understanding of Fourier series and their properties and be able to give Fourier expansions and half range Fourier series representation for a function of one variable 2. Understand Fourier Transform, the convergence issues, relation to Fourier Series and properties of Fourier Transform, and use these to derive Fourier Transforms and / or inverse Fourier Transform of functions of one variable 3. Solve first and higher order differential equations selecting from a variety of techniques covered in the syllabus 4. Demonstrate an understanding of basic principles of probability, and random variables, Work with the basic discrete distributions (Binomial, and Poisson) and the basic continuous distributions (Uniform, Exponential and Normal,) and Calculate resulting probabilities 5. Define null and alternative hypotheses know when to use a single or two tailed test and evaluate a null hypothesis using the appropriate model
ME010 402	Principles of Management	*After taking this course, the student will gain knowledge in* 1. Understanding various management concepts.

		2. Duties and functions of an individual in an organization.
ME010 403	Hydraulics Machines	*After taking this course, the student should be able to* 1. Operate every hydraulic machines 2. Analyze and identify various factors affecting the performance of machine 3. Design Protection of every hydraulics machine. 4. Ability to solve flow problems through the hydraulics machines and use of appropriate equations. 5. Ability to apply principles of fluid mechanics to the operation, design, and selection of fluid machinery such as pumps and turbines. 6. Ability to select and evaluate performances of hydropower plants.
ME010 404	Manufacturing process	*On completion of this course students are able to* 1. Work on various casting and production process 2. Analyze, identify and solve engineering problems, through application of knowledge in mathematics, science and engineering to function as good mechanical engineers and lead the people associated with. 3. Identify, formulate and solve engineering problems related to various materials and their properties using skills, techniques and state of art engineering tools. 4. Have good awareness of the trends in design, manufacturing, production and marketing. 5. Appreciate the practical applications of welding and different welding processes 6. Analyze different manufacturing processes
ME010 405	Machine drawing	*On completion of this course students are able to* 1. Produce orthographic drawings of different machine parts

		2. Produce Assembly drawings 3. Draw machine parts from assembly drawing and the appropriate uses of each class of instrument. 4. Students understand how to manage the job floor of an industry or a research organization efficiently and effectively by the optimized utilization of the resources for the maximum output. 5. Students understand and analyze the thermal and mechanical behavior of the materials and systems. 6. Students Identify and apply the most suitable process to manufacture the components.
ME010 406	Electrical Technology	*On completion of this course students are able to* 1. Work on AC and DC Generators at the power stations 2. Use AC and DC motors for various practical applications 3. Adopt efficient electric drives for industrial applications
ME010 407	Hydraulics machine Lab	*On completion of this course* 1. Students get a complete awareness on hydraulic machines and flow measuring instruments
CE010 408	Strength of materials lab	*On completion of this course* 1. Sketch the shear force and bending moment diagrams for beams with different support conditions and different load conditions. 2. Determine the stresses and strains in the bars with varying sections, tapering sections, composite members etc.
EN010 501A	Engineering Mathematics IV	*The expected outcomes of this course are that a student should be able to:* 1. Have a working knowledge of the basic definitions and theorems of the differential and integral calculus of functions of a complex variable.

		2. Evaluate real integrals using contour integration
ME010 502	Computer Aided Design & Manufacturing	*On completion of this course a student will be able to* 1. Students will get an idea about comprehensive concepts of the design aspects and its importance in computer assisted design and manufacture. 2. Students can understand and use the principles of computer aided part programming. 3. Students will be able to examine technologies those have been developed to automate manufacturing operations. 4. By studying about CAD/CAM students will be able to visualize three dimensional objects and that will enable them to design new products.
ME010 503	Advanced Mechanics of Materials	*On completion of this course a* 1 Students will be able to impart concepts of stress and strain analysis in a solid. 2 Students have an idea about the methodologies in theory of elasticity at a basic level. 3 To acquaint with energy methods to solve structural problems. 4 Analyze, identify and solve engineering problems, through application of knowledge in mathematics, science and engineering to function as good mechanical engineers and lead the people associated with. 5 Identify, formulate and solve engineering problems related to various materials and their properties using skills, techniques and state of art engineering tools.
ME010 504	Kinematics of machines	*On completion of this course a student will be able* 1. To understand the basic components and layout of linkages in the assembly of a system / machine

		2. To understand the principle involved in assembly, the displacement, velocity and acceleration at any point in a link of a mechanism. 3. To understand the motion resulting from specified set of linkages. 4. To understand and to design few linkage mechanisms and cam mechanisms for specified output motions. 5. To understand the basic concepts of toothed gearing and kinematics of gear trains.
ME010 505	IC engine & Combustion	*On completion of this course a student will have* 1. Impart the basic concepts of IC engines 2. To study different parts of an engine and process 3. Understand and analyze the engine parameters.
ME010 506	Thermodynamics	*On completion of this course a student will have* 1 Impart the basic concepts of thermodynamics. 2 By studying thermodynamics, students will be able to solve different thermal problems. 3 Understand and analyze the thermal and mechanical behavior of the materials and systems.
ME010 507	CAD/CAM lab	*On completion of this course a student* 1. Students will get an idea about comprehensive concepts of the design aspects and its importance in computer assisted design and manufacture. 2. Students can understand and use the principles of computer aided part programming.
ME010 508	Electrical and electronics Lab	*On completion of this course a student will have* 1. Work on AC and DC Generators at the power stations 2. Use AC and DC motors for various practical applications Adopt efficient electric drives for industrial applications
ME010 601	Mechanics of Machines	*On completion of this course a student will have*

		1. Students will be able to get a useful foundation and basic knowledge of mechanisms 2. Knowledge of the subject required for innovative work and advanced studies.
ME010 602	Heat and Mass transfer	*On completion of this course* 3. Students will be able to get a useful foundation and basic knowledge of heat transfer. 4. Knowledge of the subject required for innovative work and advanced studies. 5. Students will get an idea about the subject and well informed about the practical application of different formulae from an engineering point of view.
ME010 603	Thermal Systems & Applications	*On completion of this course* 1. Students will be able to get an idea about the basic concepts of different types of engines. 2. Knowledge of various thermal systems. 3. Students will get an idea about the subject and well informed about the practical application of different formulae from an engineering point of view.
ME010 604	Metrology & Machine Tools	*The expected outcomes of this course are* 1. Students will be able to understand and appreciate the importance of basic principles of traditional material removal processes. 2. Understand the application of those principles in practice. 3. To understand the principles of metrology and measurements, methods of measurement and its application in manufacturing industries.
ME010 605	Mechatronics & Control System	*The expected outcomes of this course are* 1. Students will be able to understand basic concepts of mechatronics and control systems

		2. Understand the application of those principles in practice. 3. To apply the concepts in design and manufacture of systems
ME010 606L02	Composite Materials Technology	*On completion of this course a student will have* 1. To understand the concept of composite materials. 2. Students will be able to have some idea about material selection techniques in the industry.
ME010 606L06	Project Management	*On completion of this course* 1. Students will be able to have an idea about the basic concepts of Project selection. 2. Students will be able to develop an understanding of tools, techniques and software available for Project Management.
ME010 607	Heat Engines lab	*After the completion of this course* 1. Impart the basic concepts of IC engines 2. To study different parts of an engine and process 3. Understand and analyze the engine parameters.
ME010 608	Machine tools lab	*On the completion of this course* 1. Students will be able to understand and appreciate the importance of basic principles of traditional material removal processes. 2. Understand the application of those principles in practice.
ME010 701	Design of Machine Elements	*On the completion of this course* 1 Helps the students to Analyze various designs related problems of machine elements 2 Helps to apply proper engineering tools to solve the problems 3 Provides basic knowledge on the design consideration of various machine elements
ME010 702	Dynamics of Machines	*On the completion of this course the student will have* 1 Helps to understand basic principles involved in dynamics of machines.

		2 Helps to identify and analyze various problems related to balancing of masses. 3 Helps to understand basic concepts of vibration. 4 With a good knowledge of the subject, student will be able to interpret problems related to dynamics of machineries faced in industries.
ME010 703	Gas Dynamics & Jet Propulsion	*On the completion of this course the student will have* 1 Imparts basic concepts of thermodynamics of gas flow to students. 2 Provide basic knowledge on jet propulsion. 3 Gives good awareness about the various aircraft and rocket propulsion systems. 4 Helps the students to understand and analyze the thermal behavior of gas.
ME010 704	Refrigeration & Air Conditioning	*On the completion of this course the student will have* 1 Imparts the basic concepts of Refrigeration and Air conditioning in students. 2 Gives the ability to design refrigeration or air-conditioning equipment that meets the required specification 3 Helps to solves simple problems related to refrigeration. 4 Gives an awareness of basic principles and thermodynamics of refrigeration. 5 Helps to understand various refrigeration components. 6 Helps to design the various components associated with a refrigeration system.
ME010 705	Industrial Engineering	*On completion of the course* 1 Provides an exposure to the fundamental tools and techniques in Industrial Engineering. 2 Helps to improve inter related work activities and production management in an industry. 3 Gives awareness about product development and design.

		4 Helps to manage the job floor of an industry or a research organization efficiently and effectively by the optimized utilization of the resources for the maximum output.
ME010 706L04	Sales and marketing management	*On completion of the course the student will have:* 1 Gives a general awareness about marketing and marketing management. 2 Helps in strategic planning of a business. 3 Helps to understand consumer behavior and organizational buying behavior. 4 Helps to Analyze, identify and solve various problems related to sales management.
ME010 707	Mechanical Measurements Lab	*On completion of the course the student will have:* 1. Students will be able to understand and appreciate the importance of basic principles of traditional material removal processes. 2. Understand the application of those principles in practice. 3. To understand the principles of metrology and measurements, methods of measurement and its application in manufacturing industries.
ME010 708	Advanced Machine Tools Lab	*On completion of the course the student will have:* 1. Students will be able to understand and appreciate the importance of basic principles of traditional material removal processes. 2. Understand the application of those principles in practice.
ME010 801	Design of Transmission Elements	*On completion of the course the student will be* 1 Provides basic design skill with regard to various transmission elements like clutches, brakes, bearing and gears. 2 Helps to Analyze identify and solve various problems related to transmission elements. 3 Provides good awareness in design of Internal Combustion

		parts. 4 It helps to identify and apply the most suitable process to manufacture the components
ME010 802	Operations Management	*On completion of the course the student will have:* 1 Gives an introduction to operations management. 2 Helps to understand scheduling maintenance planning and control in an industry. 3 Gives awareness of modern concept in techniques in operations management. 4 Helps the students to familiarize the main decision making scenarios (Strategic tactical and operative) that operations manager may come across. 5 Developments and understanding of main principles, techniques and tools to Analyze, diagnose and then to improve process
ME010 803	Production Engineering	Students will be able to 1. Work on various casting and production process 2. Analyze, identify and solve engineering problems, through application of knowledge in mathematics, science and engineering to function as good mechanical engineers and lead the people associated with. 3. Identify, formulate and solve engineering problems related to various materials and their properties using skills, techniques and state of art engineering tools. 4. Have good awareness of the trends in design, manufacturing, production and marketing. 5. Appreciate the practical applications of welding and different welding processes *6.* Analyze different manufacturing processes
ME 010 8041L05	Non Destructive Testing	*After completing this course students are able* 1. To know the fundamentals of NDT and MHM.

		2. To know the student to gain hands on experience on the NDT and MHM systems. 3. To know students to develop computational techniques for interpretation of the sensors in NDT and MHM applications.
ME 010 8051G01	Industrial Safety	*After completing this course students are able* 1. Understanding of Safety principles. 2. Ability to do Hazard analysis. *3.* Ability to do event tree and fault tree analysis.
ME010 806	Mechanical system lab	*After completing this course students are able* 1. Understanding of different types of governors 2. Ability to do various tests in heat transfer *3.* Ability to do works in vibrations.

2.1.2. State how and where the POs are published and disseminated (3)

(Describe in which media (e.g. websites, curricula, books, etc.) the POs are published and how the same is disseminated among stakeholders)

POs are brought to the notice of all stake holders and institutional members through the following means

- Department web page in the college Website
- Display Boards
- Brochure
- Academic News Letters

2.1.3. Indicate the processes employed for defining of the POs (5)

(Describe the process that periodically documents and demonstrates that the POs are defined in alignment with the Graduate Attributes prescribed by the NBA.)

- The PO's 1 to 10 were framed by a committee consisting of HOD, Coordinators and Class Teachers.
- The Committee meets every semester after the publication of University results to review the PO's.
- Feedbacks are also taken from the students for reviewing PO's.

2.1.4. Indicate how defined POs aligned to Graduate Attributes prescribed by the NBA (10)

(Indicate how the POs defined for the programme are aligned with the Graduate Attributes of the NBA as articulated in accreditation manual.)

The Graduate attributes were taken in to consideration during the formulation of Programme Outcomes. The table given below describes the graduate attributes of NBA and the related Programme Outcomes. It is well evident from the table that the programme outcome maintains an excellent compatibility with the graduate attributes.

Sl. No.	Graduate attributes of NBA	POs
1	Engineering Knowledge	1,2,3,4,5,6,7,10
2	Problem Analysis	1,2,6
3	Design/ Development of solution	2,4,5
4	Conduct investigations of complex problems	1,2,7
5	Modern tool usage	2, 10
6	The Engineer and Society	9
7	Environment and Sustainability	9,10
8	Ethics	3,9
9	Individual and Team Work	10
10	Communication	1,8
11	Life- Long Learning	9

2.1.5. Establish the correlation between the POs and the PEOs (5)

(Explain how the defined POs of the programme correlate with the PEOs)

PEO – PO Matrix

PEO/PO	**Program Educational Objective**										
		1	2	3	4	5	6	7	8	9	10
Program Outcome	1	X	X		X		X		X		
	2	X	X	X	X	X	X		X		
	3			X	X	X		X			

	4			X				X			
	5									X	X
	6		X							X	

2.2. Attainment of Programme Outcomes (40)

2.2.1. Illustrate how course outcomes contribute to the POs (10)

(Provide the correlation between the course outcomes and the programme outcomes. The strength of the correlation may also be indicated.)

Correlation between subjects and programme outcomes

No	Course Code	Course	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10
1	EN010 101	Engineering Mathematics I	X	x							x	
2	EN010 102	Engineering Physics	X	x							x	
3	EN010 103	Engineering Chemistry and Environmental Studies	X	x		x						x
4	EN010 104	Engineering Mechanics	X	x		x	x		x			
5	EN010 105	Engineering Graphics	X	x		x	x					

6	EN010 106	Basic Mechanical Engineering		x					x			
7	EN010 107	Basic Mechanical Engineering	X		x	x				x		x
8	EN010 108	Basic Electrical Engineering	X	x								
9	EN010 109	Basic Electronics Engineering and Information Technology	X	x								
10	EN010 110	Mechanical Workshop				x				x		
11	EN010 111	Electrical and Mechanical Workshop				x						
12	EN010 301	Engineering Mathematics II	X	x							x	
13	EN010 302	Economics and Communicatio n Skills									x	x

14	ME010 303	Fluid Mechanics	X	x			x					
15	ME010 304	Metallurgy and Material science	X						x	x		
16	ME010 305	C programming	X	x								
17	ME010 306	Strength of Materials & Structural Engineering	X	x	x		x			x		
18	ME010 307	C programming Lab	X	x								
19	ME010 308	Fluid Mechanics Lab I	X	x			x					
20	EN010 401	Engineering Mathematics III	X	x							x	
21	ME010 402	Principles of Management									x	x
22	ME010 403	Hydraulics Machines	X	x		x	x					

23	ME010 404	Manufacturing process			x	x			x	x		
24	ME010 405	Machine drawing			x	x	x			x		
25	ME010 406	Electrical Technology	X	x								
26	ME010 407	Hydraulics machine Lab	X	x		x	x					
27	CE010 408	Strength of materials lab	X	x	x		x			x		
28	EN010 501A	Engineering Mathematics IV	X	x							x	
29	ME010 502	Computer Aided Design & Manufacturing			x	x	x			x		
30	ME010 503	Advanced Mechanics of Materials	X	x	x		x			x		
31	ME010 504	Kinematics of machines				x	x					x

32	ME010 505	IC engine & Combustion	X	x								
33	ME010 506	Thermodynamics	X	x					x			
34	ME010 507	CAD/CAM lab			x	x	x			x		
35	ME010 508	Electrical and electronics Lab	X	x								
36	ME010 601	Mechanics of Machines				x	x					x
37	ME010 602	Heat and Mass transfer	X	x					x			
38	ME010 603	Thermal Systems & Applications	X	x					x			
39	ME010 604	Metrology & Machine Tools		x	x		x		x			
40	ME010 605	Mechatronics & Control System	X									

41	ME010 606L02	Composite Materials Technology					x		x	x		
42	ME010 606L06	Project Management									x	x
43	ME010 607	Heat Engines lab	X	x					x			
44	ME010 608	Machine tools lab		x	x		x		x			
45	ME010 701	Design of Machine Elements			x	x	x					
46	ME010 702	Dynamics of Machines			x	x	x					
47	ME010 703	Gas Dynamics & Jet Propulsion	X	x					x			
48	ME010 704	Refrigeration & Air Conditioning	X	x					x			
49	ME010 705	Industrial Engineering	X	x								x

50	ME010 706L04	Sales and marketing management	X	x							x	x
51	ME010 707	Mechanical Measurements Lab		x	x		x		x			
52	ME010 708	Advanced Machine Tools Lab		x	x		x		x			
53	ME010 801	Design of Transmission Elements			x	x	x					
54	ME010 802	Operations Management									x	x
55	ME010 803	Production Engineering			x	x				x		
56	ME 010 8041L05	Non Destructive Testing	X	x								
57	ME 010 8051G01	Industrial Safety	X									x
58	ME010 806	Mechanical system lab							x			x

(Relation between CO-PO is in the file AJCE/ME/FILE NBA 2)

2.2.2. Explain how modes of delivery of courses help in the attainment of the POs (10)

(Describe the different course delivery methods/modes, e.g. Lectures interspersed with discussion, asynchronous mode of interaction, group discussion, and project etc., used to deliver the courses and justify the effectiveness of these methods for the attainment of the POs. This may be further justified using the indirect assessment methods such as course-end surveys.)

The courses are delivered as

- *Lectures :*

Classroom lectures form the most basic and conventional way of disseminating information to the students. Lectures are used to convey the theoretical aspects. In these lectures students are encouraged to think originally and are made to identify and analyze engineering problems. Lectures are done with the aid of black board and chalk and presentations so that the students get a clear picture of the ideas imparted to them.

- *Presentations:*

Ideas and concepts taught during lectures are reinforced in the minds of students with the aid of presentations, both videos as well as pictures. Videos help in making students understand the working of complex engineering processes which would otherwise have been impossible to demonstrate on a two dimensional black board

- *Tutorials:*

Tutorials help the students in analyzing and solving the engineering problems on the basis of the theory dealt with during lectures. The tutorial sessions make the concept taught during lectures clearer to the students.

- *Assignments*

Assignments make students self-reliant in solution of problems through understanding of theory through practice

- *Laboratory Experiments*

Exposes the students to experimental and practical aspects of theory studied in classrooms. They help students in verifying the theories learned by experiments through interpretation of results. Since laboratory experiments are usually done in teams, they help develop the spirit of working together as a team in the minds of young students

- *Community service programme*

Students of the department are encouraged to become responsible citizens of the country by encouraging them take part in community service programs. Community service initiatives help them to understand real life problems faced by different strata of society and encourage them to come up with novel and sustainable solutions for these problems

- *Industrial visits*

Industrial visits give the students a firsthand understanding of how big industries work. Industrial visit is mandatory for all students of the department at least once in a year

- *Industrial training*

Students are encouraged to undergo industrial training during their semester break in some industry of their choice. Also a report has to be submitted at the end of industrial training. Industrial training provides an insight to students about what is happening in the real world and also supplements their class room knowledge

- *Software training programmes*

The advent of various software's has made life of an engineer easy. So it is essential that students are taught the nuances of various software's which would help them in giving better shape to their ideas as also give them an added advantage in their career prospects. With this in mind the department has taken a lead in teaching students soft wares like C, AUTO CAD, PRIMAVERA, ANSYS etc.

- *Seminars and workshops*

Students are made to present a seminar during their final year. In this seminar students are supposed to make a seminar presentation in an area of their choice by referring to various journals of national and international repute

- *Participation in paper presentations and technical competitions at the national and international level*

Students are encouraged to participate in paper presentations and technical competitions at the national and international levels.

- *Projects (in three levels):*

Students have to carry out a project at micro level (second year) where they chose their area of interest. Micro project mainly aims at familiarizing students with literature review and introduction to apply their class room knowledge to research. Mini level projects (third year project) aims at exposing students to real world scenarios of the theory they have studied in class in their area of interest. Main level (final year) project aims at training them to find solutions to real world problems with their technical knowhow. The development of students from micro to mini to main project has been found to be very effective in their growth as engineers.

- *e Learning: online Courses*

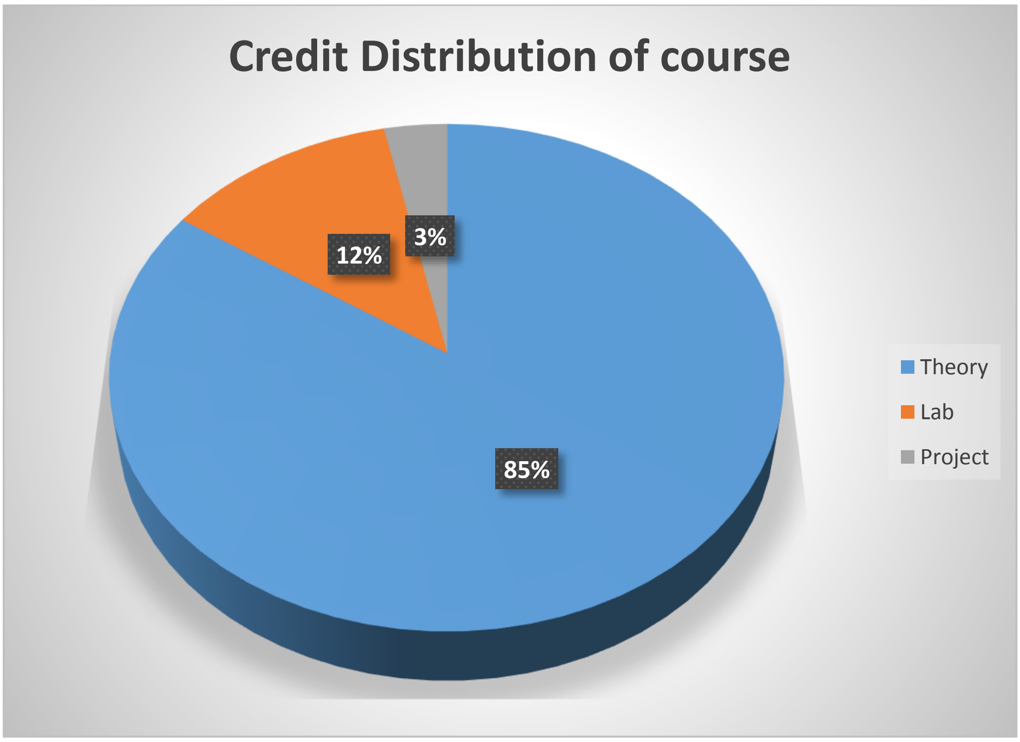
Students are encouraged to use online materials of their courses and also to attend additional online courses to gain knowledge and experience beyond their curriculum

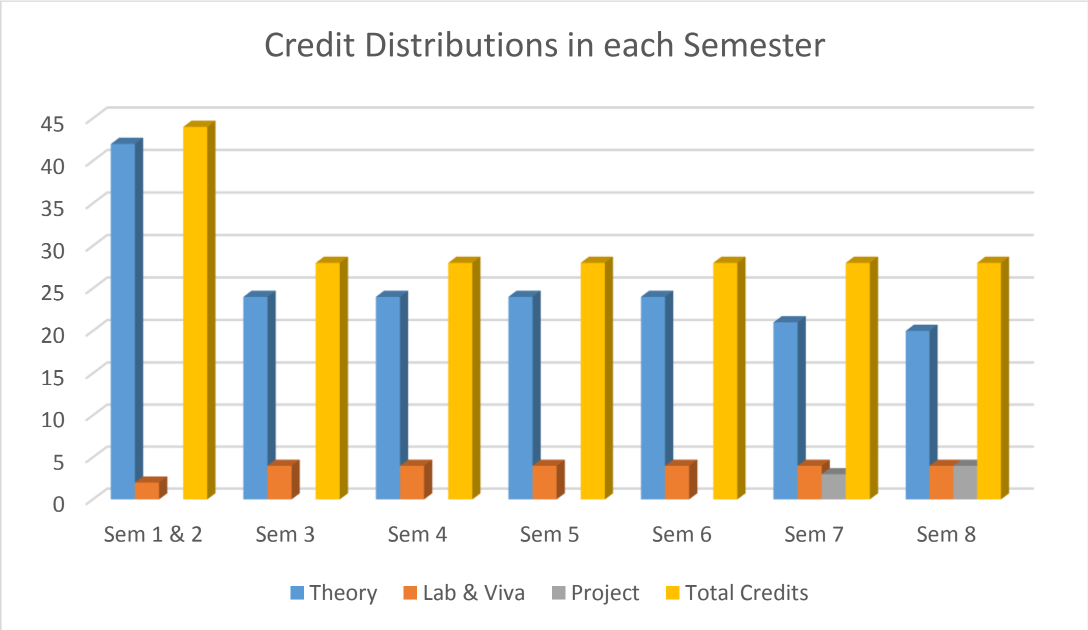
2.2.3. Indicate the extent to which the laboratory and project course work are contributing towards the attainment of the POs (20)

(Justify the balance between theory and practical for the attainment of POs. Justify how the various project works (a sample of 20% best and average projects from total projects) carried as part of the programme curriculum contribute towards the attainment of the POs.)

- The programme aims at providing an all-round exposure to students in mechanical engineering including practical solutions and finding solution to real world engineering problems.
- The curriculum of the programme are so framed that an ample number of laboratory courses are included so that the practical knowhow of the student is improvised along with the theoretical knowledge. The laboratory works are also conducted in groups which ensures the development of team working skills of the students.
- The project course work allows the students to choose a specific area of interest and thereafter have a better understanding in that area, and find solution to a real world problem in that areas utilizing the technical know how they gained in the class room. Project course work makes students capable of working in deadlines and improves their presentation and communication skills.

The following charts show the quantitative description of the credit distribution among the theory, practical and project course works.





2.2.4. Indicate how assessment tools used to assess the impact of delivery of course/course content contribute towards the attainment of course outcomes/ programme outcomes

Direct Assessment Tools

- *Assignment:* The assignment is a qualitative performance assessment tool designed to assess student's knowledge of engineering practices, framework and problem solving
- *Tutorial Sessions:* Tutorial sessions for students provide a clear assessment of the delivery of the course contents.
- *Series Exams (Conducted at Institutional Level):* Series exams conducted twice a semester helps in the continuous evaluation of students performance
- *Mini projects, micro projects:* Small Research Projects are given to students and evaluated keeping them updated with the latest technical know how
- *University Examination (Conducted at University Level):* The examination further ensure that the students attain the course outcomes there by the programme outcomes Additionally the examination ensures that only those students who have attained the programme outcomes are actually awarded the programme certificates
- *Viva Voce At The End Of Programme* : A viva voce is conducted as a part of assessing students' knowledge in the subjects

Indirect Assessment Tools

- *Programme Level Statistics*: Result Analysis, survey of students participating in conference workshops, paper presentations, internships, industrial training are conducted semester wise
- *Alumni Survey:* Conducted after one year of graduation

2.3. Evaluation of the attainment of Programme Outcomes (75)

2.3.1. Describe assessment tools and processes used for assessing the attainment of each PO (50)

The various tools for assessing the students

- Assignments,
- mini-projects,
- quizzes,
- examinations,
- presentations,
- reports and
- Viva-voce are used for assessing the attainment of each PO.

Assignments, quizzes and examinations contribute to assessing the students' ability to use fundamental concepts, quantitative, numerical and analytical skills.

Laboratory exams, mini projects and projects contribute to the assessment of practical skills which reflect the ability of students to implement ideas and techniques.

Reports, oral presentations and viva-voce contribute to the assessment of overall communication skills and dissemination of ideas.

These assessments are carried out periodically and hence allow the faculty members to monitor and provide attention to the students who may not be attaining the PO's to the required level.
This ensures that all students attain the minimum level of each programme outcomes

(a)Tutorial questions ranging from basic to challenging problems are used to assess the fundamental concepts, numerical and analytical skills.

Assignments on specific topics which involve application of concepts to solve a wide range of problems are given frequently to the students.

Mini projects/practical assignments/ power point presentations are used to evaluate the students' ability to use various tools, equipment, components and software.

Participation and involvement in different clubs/societies such as IEEE Student Branch, Youth club, Lions club, technical fest and cultural fest to evaluate the curricular, co-curricular and extra-curricular activities and the abilities to work as a team in a professional environment

.

Assessment of project work to ensure proficiency in the students' chosen field of interest and the tools necessary to practice that field.

Students are encouraged to appear for GATE, GRE, CAT etc. and scores of such exams are also used as secondary tools to evaluate attainment of PO's
(b) Tutorials are assessed weekly,

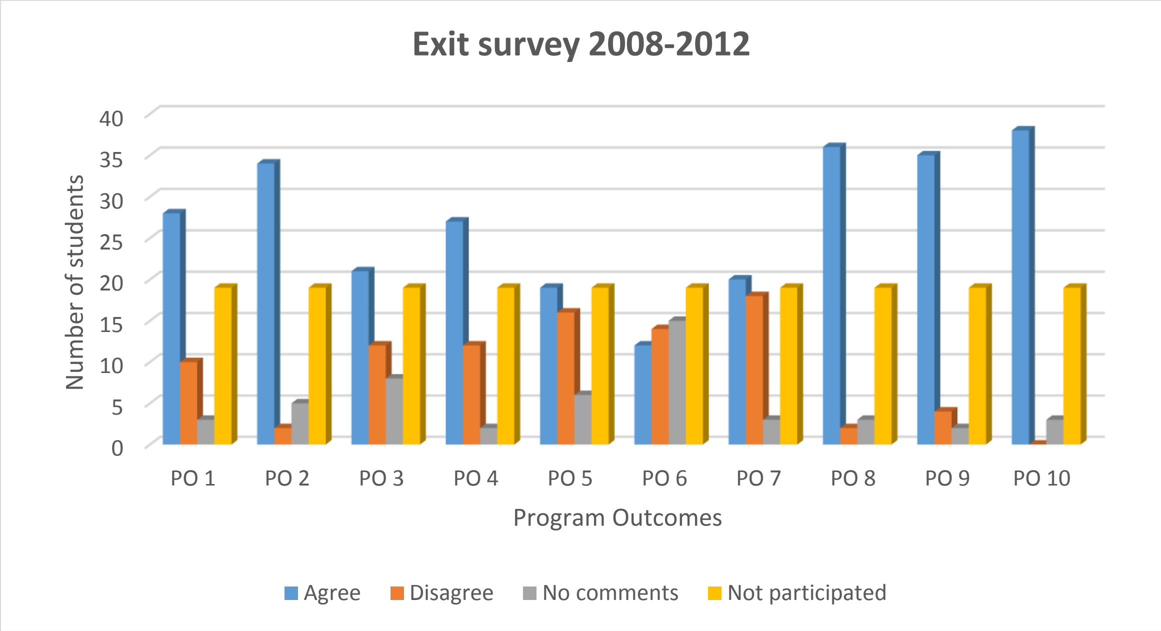
- At least 5 assignments are taken each semester
- One mini-project associated with each course.
- Project presentation is taken thrice per semester in the presence of a project panel as well as weekly/bi-weekly meetings and discussion with the concerned project supervisor.
- Every club/society has certain activity every month and annual technical and cultural fests are organized and actively participated.

Describe the assessment process that periodically documents and demonstrates the degree to which the Programme Outcomes are attained. Also include information on:

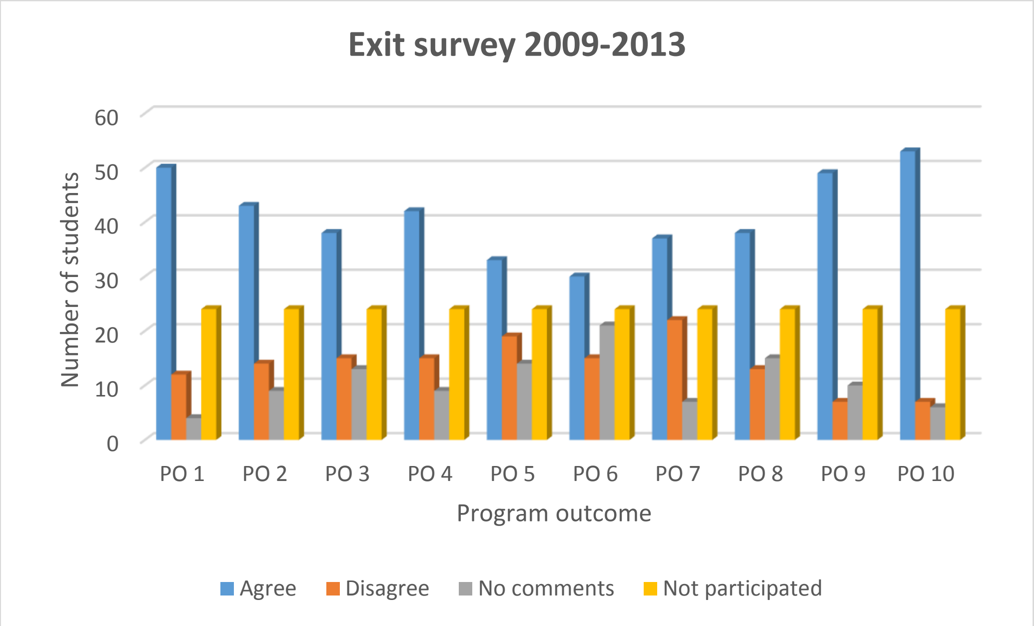
a) Listing and description of the assessment processes used to gather the data upon which the evaluation of each the Programme Outcome is based. Examples of data collection processes may include, but are not limited to, specific exam questions, student portfolios, internally developed assessment exams, project presentations, nationally-normed exams, oral exams, focus groups, industrial advisory committee;
b) The frequency with which these assessment processes are carried out.

2.3.2. Indicate results of evaluation of each PO (25)

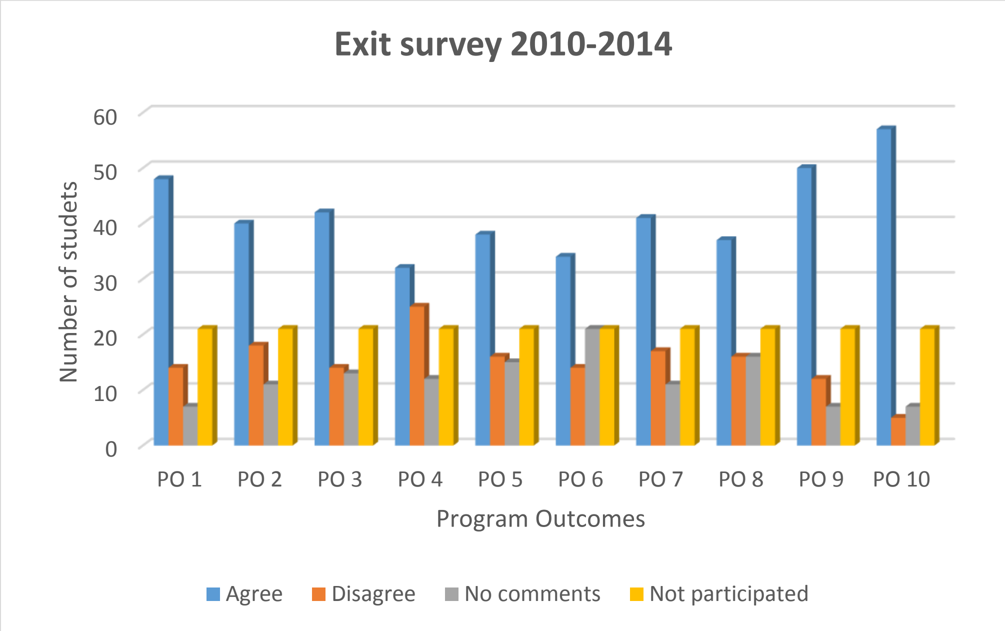
- The students expected to be reasonably proficient with each of the program outcomes
- The achievement of program outcomes are assessed with the help of course outcomes of the relevant courses through different methods.
- The final grading is based on mid-semester and final-semester and internal assessment.
- The results are documented and maintained by the administrative office.
- The results are displayed on web server so that the students and their parents have an easy and all time access to the progress of students.



In exit survey conducted for 2008-2012 batch, the number of students participated is 40 out of 60.



In exit survey conducted for 2009-2013 batch, the number of students participated is 66 out of 90.



In exit survey conducted for the 2010-2014 batch, the number of students participated is 69 out of 90.

c) The expected level of attainment for each of the Program Outcomes;

d) Summaries of the results of the evaluation processes and an analysis illustrating the extent to which each of the programme outcomes are attained; and

e) How the results are documented and maintained.

2.4. Indicate how the results of evaluation of achievement of the POs have been used for redefining the POs (10)

(Articulate, with rationale, how the results of the evaluation of the POs have been used to review/redefine the POs)

2.4.1. Indicate how results of assessment used for curricular improvements

- The feedback obtained from interviewers and industry delegates who had either hired or interviewed our students was used to emphasize the importance of fundamental concepts, analytical thinking and practical scenarios in the curriculum.
- The results of the evaluation are communicated to the entire department and a departmental meeting ensues to propose changes in the curriculum so that the attainments of PO’s are maximized.
- BOS reviews all the proposals put forward in the departmental meeting and finalizes and puts forward its recommendations to the Academic Council of the University.
- The Academic Council then deliberates on the proposals put forward to Governing Council which gives approval and communicates the approved proposal back to the department for implementation.

2.4.2 Indicate how results of assessment used for improvement of course delivery and assessment

- The results of evaluation are discussed in faculty meetings and new methods of course delivery and evaluation are formulated. New and effective methods will be evolved for more efficient delivery of courses
- In times of need special coaching is provided to students, like remedial classes.
- Same are discussed in Academic Council of the institution and decisions taken

2.4.3 State the process used for revising or redefining POs

The academic council meets to review the results of evaluation of PO s. Thereafter the academic council meets the staff and faculty members to discuss how the attainment of PO s can be improved and how PO s may be revised and redefined.

3. Programme Curriculum (125)

3.1. Curriculum (15)

3.1.1. Describe the structure of the curriculum (5)

Course Code	Course Title	Total Number of contact hours				Credits
		Lecture (L)	Tutorial (T)	Practical# (P)	Total Hours	
EN010 101	Engineering Mathematics I	2	1	-	3	5
EN010 102	Engineering Physics	1	1	-	2	4
EN010 103	Engineering. Chemistry & Environmental Studies	1	1	-	2	4
EN010 104	Engineering Mechanics	3	1	-	4	6
EN010 105	Engineering Graphics	1	3	-	4	6
EN010 106	Basic Civil Engineering	1	1	-	2	4
EN010 107	Basic Mechanical Engineering	1	1	-	2	4
EN010 108	Basic Electrical Engineering	1	1	-	2	4
EN010 109	Basic Electronics Engineering. & Information Technology	2	1	-	3	5
EN010 110	Mechanical Workshop	-		-	3	1
EN010 111	Electrical and Civil Workshops	-		-	3	1
EN010 301A	Engineering Mathematics II	2	2	-	3	4
EN010 302	Economics and Communication Skills	2	2	-	3	4
ME010 303	Fluid Mechanics	2	2	-	3	4
ME010 304	Metallurgy & Material Science	3	1	-	3	4
ME010 305	Programming in C	3	1	-	3	4

#Seminars, project works may be considered as practical

ME010 306 (CE)	Strength of Materials & Structural Engineering	3	1	-	3	4
ME010 307	Computer Programming Lab	-	-	3	3	2
ME010 308	Fluid Mechanics Lab	-	-	3	3	2
EN010 401	Engineering Mathematics III	2	2	-	3	4
EN010 402(ME)	Principles of Management(C,M,P,L,A,T)	3	1	-	3	4
ME010 403	Hydraulic Machines	2	2	-	3	4
ME010 404	Manufacturing Process	3	1	-	3	4
ME010 405	Machine Drawing	3	1	-	3	4
ME010 406	Electrical Technology	3	1	-	3	4
ME010 407	Hydraulic Machines Lab	-	-	3	3	2
ME010 408	Strength of Materials Lab	-	-	3	3	2
EN010 501A	Engineering Mathematics IV	2	2	-	3	4
ME010 502	Computer Aided Design & Manufacturing	2	2		3	4
ME010 503	Advanced Mechanics of Materials	3	1	-	3	4
ME010 504(EE)	Kinematics of Machinery	3	1	-	3	4
ME010 505	I.C. Engines & Combustion	3	1	-	3	4
ME010 506	Thermodynamics	3	1	-	3	4
ME010 507	CAD/CAM Lab	-	-	3	3	2
ME010 508(EE)	Electrical & Electronics Lab	-	-	3	3	2
ME010 601	Mechanics of Machines	2	2	-	3	4
ME010 602	Heat & Mass transfer	2	2	-	3	4
ME010 603	Thermal Systems & Applications	3	1	-	3	4
ME010 604	Metrology & Machine Tools	3	1	-	3	4
ME010 605	Mechatronics & Control System	3	1	-	3	4

ME010 606Lxx	Elective I	3	1	-	3	4
ME010 607	Heat Engines Lab	-	-	3	3	2
ME010 608	Machine Tools Lab	-	-	3	3	2
ME010 701	Design of Machine Elements	2	2	-	3	4
ME010 702	Dynamics of Machines	2	2	-	3	4
ME010 703	Gas Dynamics & Jet Propulsion	3	1	-	3	4
ME010 704	Refrigeration & Air Conditioning	3	1	-	3	4
ME010 705	Industrial Engineering	3	1	-	3	4
ME010 706L04	Sales& Marketing Management	3	1	-	3	4
ME010 707	Mechanical Measurements Lab	-	-	3	3	2
ME010 708	Advanced Machine Tools Lab	-	-	3	3	2
ME010 709	Seminar	-	-	2		2
ME010 710	Project	-	-	1		1
ME010 801	Design of Transmission Elements	3	2	-	3	4
ME010 802	Operations Management	2	2	-	3	4
ME010 803	Production Engineering	2	2	-	3	4
ME010 804L05	Non Destructive Testing	2	2	-	3	4
ME010 805G01	Industrial Safety	2	2	-	3	4
ME010 806	Mechanical Systems Lab	-	-	3	3	2
ME010 807	Project	-	-	6		4
ME010 808	Viva Voce	-	-	-	-	2
EN010808	Viva	-	-	-	-	2

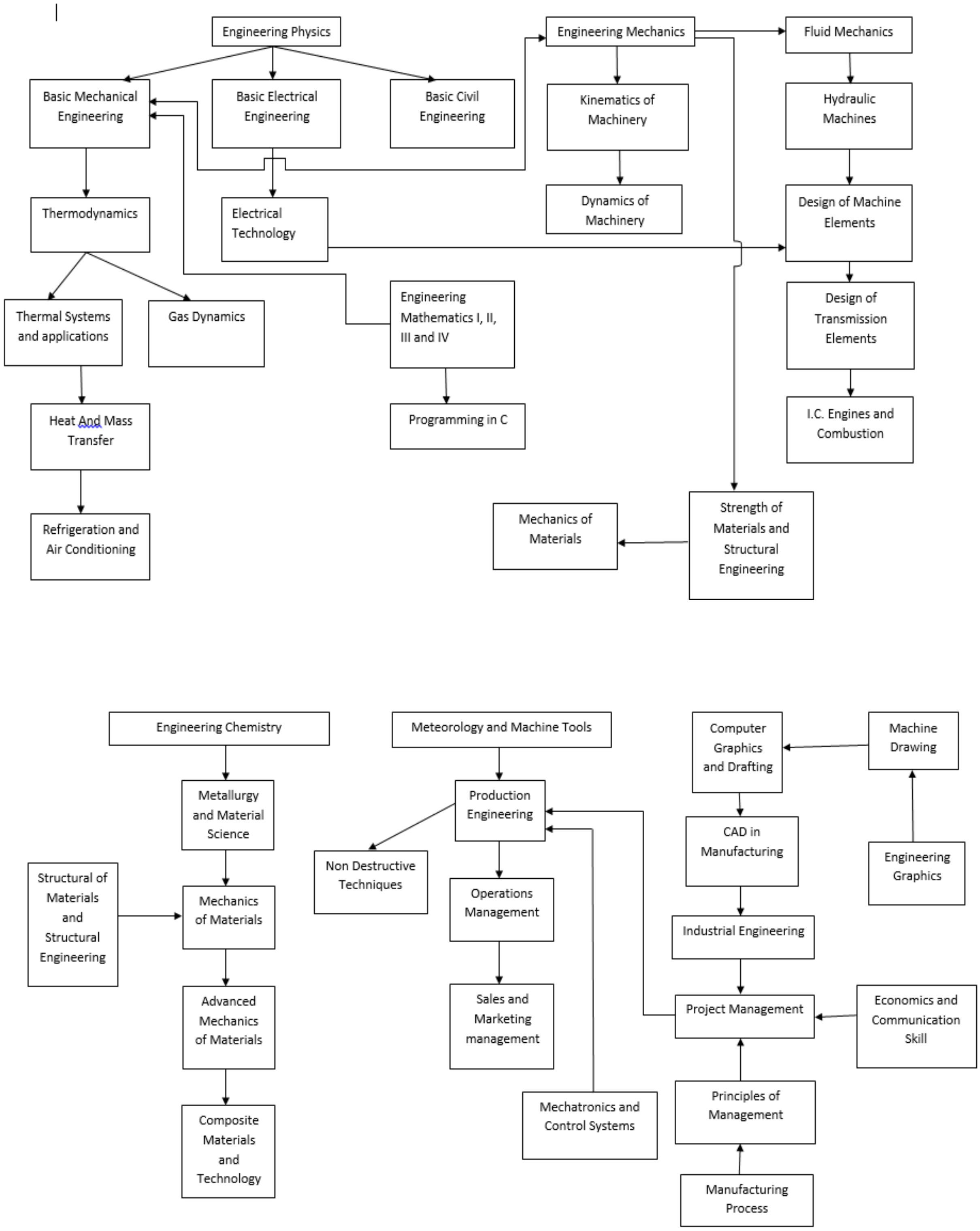
Elective I

ME 010 606L02 Composite Materials Technology

ME 010 606L06 Project management

3.1.2. Give the Prerequisite flow chart of courses (5)

(Draw the schematic of the prerequisites of the courses in the curriculum)



3.1.3. Justify how the programme curriculum satisfies the programme specific criteria (5)

(Justify how the programme curriculum satisfies the programme specific criteria specified by the American professional societies relevant to the programme under accreditation)

➢ The scheme, number of courses, contents of the courses are all designed to cater to the requirements of students. The curriculum aims at imparting thorough mechanical engineering background to students by developing a strong base and depth of knowledge in the subject.

➢ The curriculum is framed by taking the PEOs and POs of the degree programme as basis. It is well evident from the above defined pre requisite chart that the curriculum is so framed that a student with science and mathematics background at Plus Two gets gradually evolved into a Mechanical engineer through exposure towards all subjects of Mechanical engineering step by step.

➢ The curriculum also aims at the enhancement of the social commitment of the students along with their academic development.

➢ As Mechanical engineers are expected to be professionals with strong ethics also, they are life-long students with strong craving for knowledge. The department aims at developing undergraduates with passion for learning, high social sense and professional in all aspects.

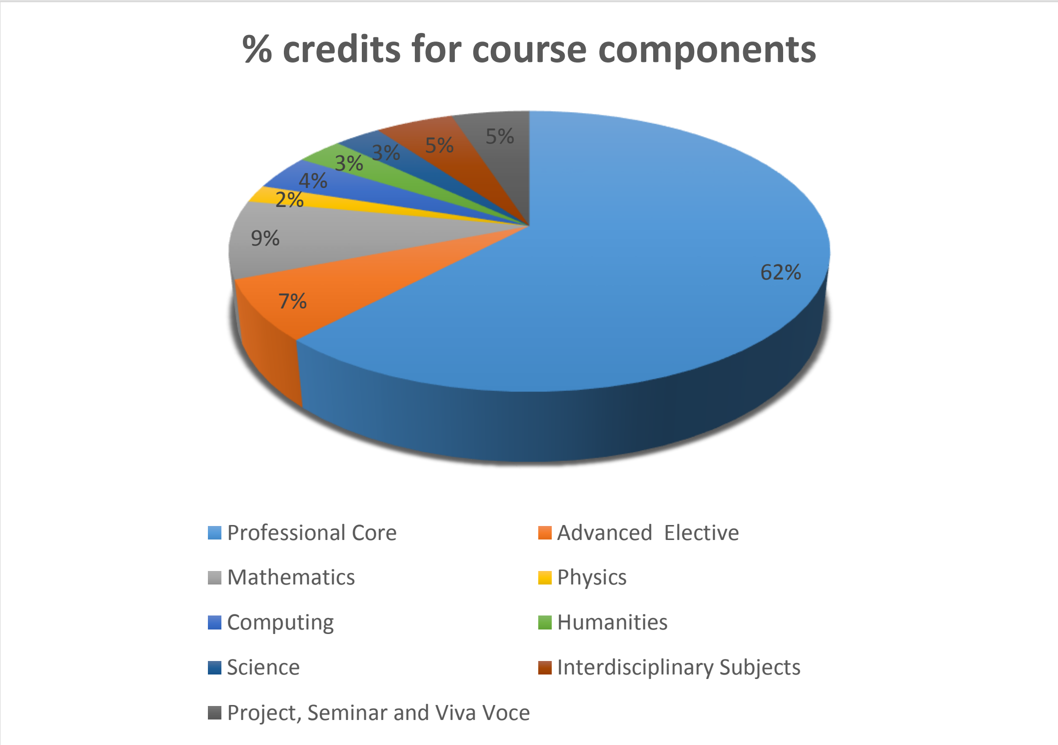
3.2 State the components of the curriculum and their relevance to the POs and the PEOs (15)

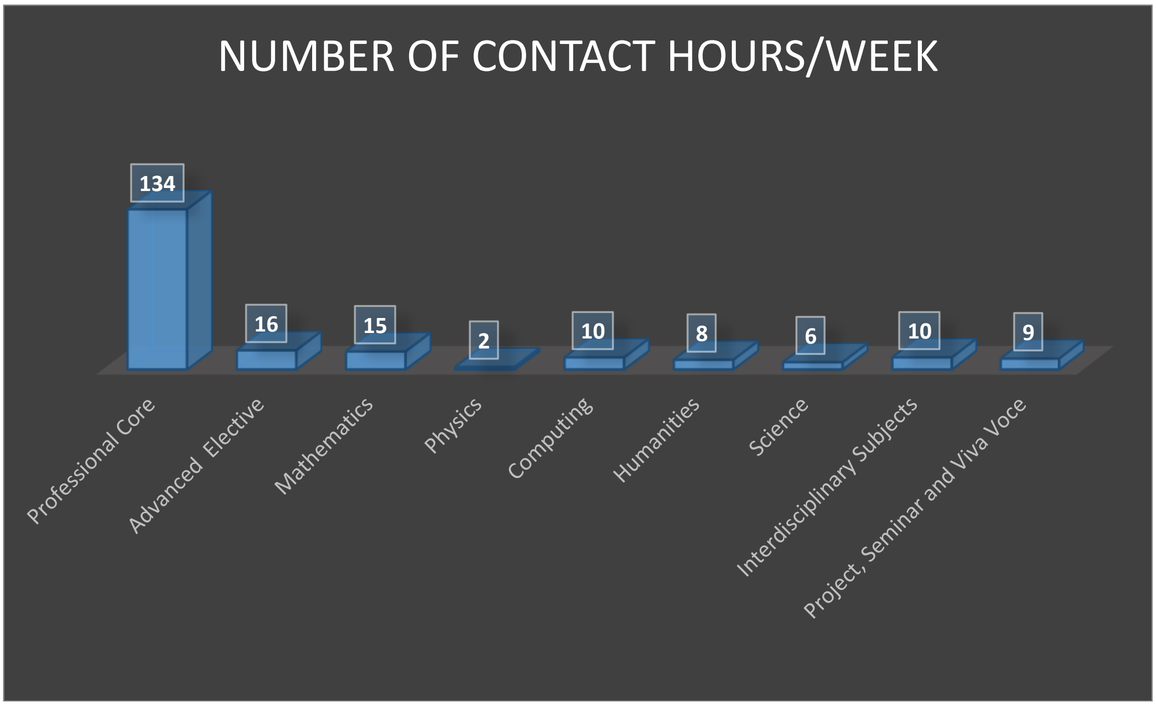
The curriculum is divided into professional core subjects as well as advanced elective subjects in addition to subjects in basic sciences, mathematics and humanities. Interdisciplinary subjects are also included in the curriculum. Projects and seminars help to augment the research aptitude of students

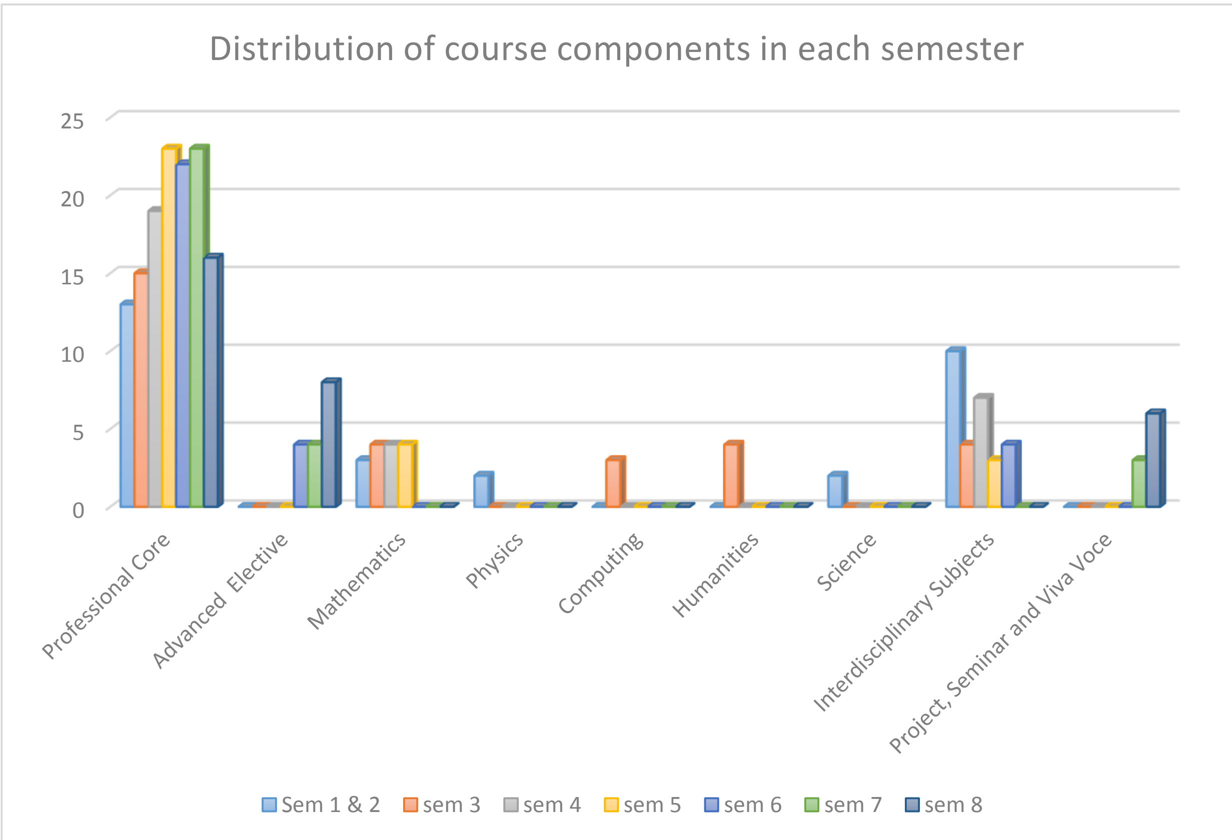
Also the components of curriculum enables the graduate to attain various PO's by the culmination of the programme. Graduates acquire the ability to analyze, evaluate and design machines and parts, transportation equipment systems, hydraulic structure etc. and also to plan and execute mechanical engineering projects.

Programme curriculum grouping based on different components

Course Component	Curriculum Content (% of total number of credits of the programme)	Total number of contact hours/	Total number of credits	POs	PEOs
Professional Core	59.9	134	127	1,2,3,4,5,6,7	1,2,3
Advanced Elective	7.54	16	16	1,2,8,9,10	1,2,3,4
Mathematics	8.96	15	19	1,2,8,10	1,2
Physics	1.88	2	4	1,2,8,10	1,2
Computing	4.24	10	9	1,2,10	1,2,3,5
Humanities	3.77	8	8	8,9	4,5,6
Science	3.77	6	8	1,2	1,6
Interdisciplinary Subjects	5.66	10	12	1,2,8,10	5,6
Project, Seminar and Viva Voce	4.2	9	9	8,9,10	4,5,6




NUMBER OF CONTACT HOURS/WEEK
134
16
15
2
10
8
6
10
9
Professional Core
Advanced Elective
Mathematics
Physics
Computing
Humanities
Science
Interdisciplinary Subjects
Project, Seminar and Viva Voce


Distribution of course components in each semester
25
20
15
10
5
0
Professional Core
Advanced Elective
Mathematics
Physics
Computing
Humanities
Science
Interdisciplinary Subjects
Project, Seminar and Viva Voce
Sem 1 & 2
sem 3
sem 4
sem 5
sem 6
sem 7
sem 8

3.3. State core engineering subjects and their relevance to Programme Outcomes including design experience (30)

(Describe how the core engineering subjects in the curriculum provide the learning experience with the complex engineering problems)

No	Course code	Course	1	2	3	4	5	6	7	8	9	10
1	EN010 101	Engineering Mathematics I	x	x						x		X
2	EN010 102	Engineering Physics	x	x						x		X
3	EN010 103	Engineering Chemistry and Environmental Studies	x	x		x					x	
4	EN010 104	Engineering Mechanics	x	x		x	x	x				
5	EN010 105	Engineering Graphics	x	x		x	x					
6	EN010 106	Basic Mechanical Engineering		x				x				X
7	EN010 107	Basic Mechanical Engineering	x		x	x			x		x	X
8	EN010 108	Basic Electrical Engineering	x	x								X
9	EN010 109	Basic Electronics Engineering and Information Technology	x	x								x
10	EN010 110	Mechanical Workshop				x			x			x
11	EN010 111	Electrical and Mechanical Workshop				x						X

12	EN010 301	Engineering Mathematics II	x	x						x		X
13	EN010 302	Economics and Communication Skills								x	X	
14	ME010 303	Fluid Mechanics	x	x			x					X
15	ME010 304	Metallurgy and Material science	x					x	x			
16	ME010 305	C programming	x	x								
17	ME010 306	Strength of Materials & Structural Engineering	x	x	x		x		x			
18	ME010 307	C programming Lab	x	x								
19	ME010 308	Fluid Mechanics Lab I	x	x			x					X
20	EN010 401	Engineering Mathematics III	x	x						x		X
21	ME010 402	Principles of Management								x	X	
22	ME010 403	Hydraulics Machines	x	x		x	x					X
23	ME010 404	Manufacturing process			x	x		x	x			
24	ME010 405	Machine drawing			x	x	x		x			
25	ME010 406	Electrical Technology	x	x								X
26	ME010 407	Hydraulics machine Lab	x	x		x	x					
27	CE010 408	Strength of materials lab	x	x	x		x		x			
28	EN010 501A	Engineering Mathematics IV	x	x						x		X
29	ME010 502	Computer Aided Design &			x	x	x		x			

		Manufacturing										
30	ME010 503	Advanced Mechanics of Materials	x	x	x		x		x			
31	ME010 504	Kinematics of machines				x	x				X	X
32	ME010 505	IC engine & Combustion	x	x								X
33	ME010 506	Thermodynamics	x	x				x				X
34	ME010 507	CAD/CAM lab			x	x	x		x			
35	ME010 508	Electrical and electronics Lab	x	x								X
36	ME010 601	Mechanics of Machines				x	x				X	X
37	ME010 602	Heat and Mass transfer	x	x				x				X
38	ME010 603	Thermal Systems & Applications	x	x				x				X
39	ME010 604	Metrology & Machine Tools		x	x		x	x				
40	ME010 605	Mechatronics & Control System	x									X
41	ME010 606L02	Composite Materials Technology					x	x	x			
42	ME010 606L06	Project Management								x	X	X
43	ME010 607	Heat Engines lab	x	x				x				X
44	ME010 608	Machine tools lab		x	x		x	x				
45	ME010 701	Design of Machine Elements			x	x	x					X
46	ME010 702	Dynamics of Machines			x	x	x					X
47	ME010 703	Gas Dynamics & Jet Propulsion	x	x				x				

48	ME010 704	Refrigeration & Air Conditioning	x	x				x				X
49	ME010 705	Industrial Engineering	x	x							X	X
50	ME010 706L04	Sales and marketing management	x	x						x	X	X
51	ME010 707	Mechanical Measurements Lab		x	x		x	x				
52	ME010 708	Advanced Machine Tools Lab		x	x		x	x				
53	ME010 801	Design of Transmission Elements			x	x	x					X
54	ME010 802	Operations Management								x	X	X
55	ME010 803	Production Engineering			x	x			x			
56	ME 010 8041L05	Non Destructive Testing	x	x								X
57	ME 010 8051G01	Industrial Safety	x								X	X
58	ME010 806	Mechanical system lab						x			X	X

3.4. Industry interaction/internship (10)

(Give the details of industry involvement in the programme such as industry-attached laboratories and partial delivery of courses and internship opportunities for students)

The department invites experts from industry for invited lectures that the students and staff attend. The lectures result in lively discussion thus imparting current state of the art knowledge to students and staff. A list of some of the lectures held since last two years are given below.

Academic year	Event	Date	Coordinated by	Comments
2012-2013	Inauguration of association of mechanical engineers	23-02-1013	AME	Inaugurated by Mr. Smeer Abdul Azeez, scientist-D, Navel Physical and Oceanographic Lab. (NPOL-DRDO). Session taken by Dr. .M.M Monippilly (IIM, Ahemdabad)

2013-2014	Inauguration of Indian Institution of Industrial Engineering (IIIE) – Student chapter at AJCE Annual Meet of Association of Mechanical Engineers	03-04-2014	Indian Institution of Industrial Engineering (IIIE) Association of Mechanical Engineers	Prof R.A.D Pillai, Former Deputy Director, VSSC and National Council member of IIIE inaugurated the IIIE chapter of AJCE.
2013-2014	Launching website for Royal blood cell	04-04-2014	Royal Blood Cell	The Royal Blood Cell (RBC), a Mechanical Department initiative under the association, launched their official website which will club the blood group database of students from different engineering colleges in Kerala.
2013-2014	MECHZTACY 2k14- Cultural Eve	04-04-2014	Dept. of Mechanical Engineering Students	The vibrant students of the Mechanical Department put up a enthralling performance.
2014-2015	Workshop on *Employability quotient of the student from a Global perspective'*	*20/09/14* FN	Association of Mechanical Engineers	Association of Mechanical Engineering (AME) organized a workshop by Mindprints Inc. Bangalore
2014-2015	Technical Talk	*20/09/14* AN	Association of Mechanical Engineers	Mr. K. Manikandan, GM, Ashok Leyland delivered a talk on 'Challenges in Automotive job sector
2014-2015	Ignition-2014	28th August 2014	Association of Mechanical Engineering (AME)	Inauguration of Association of Mechanical Engineering (AME) - IGNITION 2014 by Mr. P.S Suresh Kumar -General Manager, District Industries Centre (DIC), Kottayam on 28th August 2014 (Thursday) at 10. 30 am in the College Auditorium.
2014-2015	Talk on "Robotics"	30-08-2014	Mechanical Engineering	The sessions were taken by Mr. Sunil Paul (Asst. Prof, Muthoot college of engineering)

			Departmen t	
2014-2015	One day seminar on “Recent Trends in Nano Composites”	15/08/2014	ISTE Amal Jyothi Chapter and ME department	The sessions were handled by Dr. K Padmanabhan, Asst. Director and Head, Centre for excellence in Nano composites, VIT University and Dr. Soney C George, Amal Jyothi College of Engineering
2014-2015	Seminar on "Motivation and Professional Challenges"	01-08-2014	Institution Engineers India students’ chapter	The sessions were taken by Capt. George Kurian, Former Director Coal India limited by Institution Engineers India students’ chapter
2014-2015	Seminar on “ISRO Launch Vehicles”	09-04-2015.	Institution Engineers India students’ chapter	IEI students' Chapter of AJCE organized a seminar on the topic “ISRO launch Vehicles”
2014-2015	Seminar on "Propulsion Through Ages	28th of March 2015	Institution Engineers India students’ chapter	Department of Mechanical Engineering and Institution of Engineers (India) Students' Chapter organized a Technical talk on "Propulsion Through Ages " by Sri Jasperlal, VSSC Trivandrum

3.5. Illustrate the measures and processes used to identify the curricular gaps to the attainment of the COs/POs (15)

(Details of the processes used to curricular gaps to the attainment of defined course outcomes and programme)

The curricular gaps in the attainment of CO s and PO s are compensated by the following measures

Add On Courses:

- Add on courses are provided for training in mechanical engineering softwares and high end survey instruments which are beyond the curriculum so that a student becomes a full equipped mechanical engineer up on passing out.

Minor Projects:

- Micro projects and Mini projects are carried out by students at second and third years of the course so that they are exposed to real world problems and the derivation of solutions to these problems

Industrial Training and Community Service:

- The academic and social commitment of a student is developed by undergoing trainings and services

3.6. Indicate the content beyond syllabus imparted for the attainment of the COs/POs (35)

(Details of the content beyond syllabus imparted for the attainment of the COs/POs. This information may be provided course wise or module wise)

- Certified course on Auto CAD

AutoCAD is a computer-aided design program used in many industries, most commonly in engineering and drafting. AutoCAD training program teaches students to create 2- or 3-dimensional technical drawings, develop template files, coordinate reference drawings and build a library of reusable symbols.

- Certified course on CATIA

CATIA enables the creation of 3D parts, from 3D sketches, sheet metal, composites, and molded, forged or tooling parts up to the definition of mechanical assemblies. The software provides advanced technologies for mechanical surfacing & BIW. It provides tools to complete product definition, including functional tolerances as well as kinematics definition. CATIA provides a wide range of applications for tool design, for both generic tooling and mold & die.

- Certified course on PRIMAVERA

Primavera P6 is an amazing project management application that is used worldwide and which helps in planning, managing and controlling project costs, activities, resources, effectively and easily.

- Certified course on ABAQUS

Abaqus FEA (formerly ABAQUS) is a software suite for finite element analysis and computer-aided engineering, originally released in 1978. The name and logo of this software are based on the abacus calculation tool. The Abaqus product suite consists of five core software products.

- CNC machine training

Computer numerically controlled (CNC) machinery is used by CNC operators to cut and shape metal and plastic for various types of manufacturing. CNC operators must have mechanical skills and be able to read blueprints. Increasingly, many employers also require CNC operators to have basic computer programming skills and experience with computer-aided design and manufacturing programs. Licensing is typically not required, although many candidates are either trained on the job through apprenticeships or receive post-secondary certificates in manufacturing technology. A high school diploma is typically required. For person that enjoying working with hands in a challenging, fast-paced environment, then this career might be for you.

It has been observed that imparting training in the above mentioned Software and instruments has helped students gain additional knowledge other than those prescribed under curriculum. The certified courses have been of great advantage to the students in the job market too. It was ensured that the additional courses offered to the students helped them fare better in their careers thus doing justice to the CO/PO's envisaged by the department

3.7. Course Syllabi (5)

(Include, in appendix, a syllabus for each course used. Syllabi format should be consistent and shouldn't exceed two pages.)

The syllabi format may include:

- Department, course number, and title of course
- Designation as a required or elective course
- Pre-requisites
- Contact hours and type of course (lecture, tutorial, seminar, project etc.)
- Course Assessment methods (both continuous and semester-end assessment)
- Course Outcomes
- Topics covered
- Text books, and/or reference material

Please see Appendix I

Mahatma Gandhi University: Revised Scheme For

B. Tech. Syllabus Revision 2010

http://www.ajce.in/amal-jyothi/courses/mechanical-engineering/me-syllabus/

Course CODE	**Course Title**	Hours/week			Internal-Mark	External Marks	End-Semester hours	Credits
		L	**T**	**P/D**				
Semester 1 & 2								
EN010 101	Engineering Mathematics I	2	1	-	50	100	3	5
EN010 102	Engineering Physics	1	1	-	50	100	3	4
EN010 103	Engineering Chemistry& Environmental Studies	1	1		50	100	3	4
EN010 104	Engineering Mechanics	3	1	-	50	100	3	6
EN010 105	Engineering Graphics	1		3	50	100	3	6
EN010 106	Basic Civil Engineering	1	1	-	50	100	3	4
EN010 107	Basic Mechanical Engineering	1	1	-	50	100	3	4
EN010 108	Basic Electrical Engineering	1	1	-	50	100	3	4
EN010 109	Basic Electronics Engineering. & Information Technology	2	1	-	50	100	3	5
EN010 110	*Mechanical Workshop*	0	-	3	50	-	3	1
EN010 111	*Electrical and Mechanical Workshops*	-	-	3	100	-	3	1
Semester III								
EN010 301A	Engineering Mathematics II	2	2	-	50	100	3	4
EN010 302	Economics and Communication Skills	2	2	-	50	100	3	4 (3+1)
ME010 303	Fluid Mechanics	2	2	-				4
ME010 304	Metallurgy & Material Science	3	1	-	50	100	3	4
ME010 305	Programming in C	3	1	-	50	100	3	4
ME010 306 (CE)	Strength of Materials & Structural Engineering	3	1	-	50	100	3	4
ME010 307	*Computer Programming Lab*	-	-	3	50	100	3	2
ME010 308	*Fluid Mechanics Lab*	-	-	3	50	100	3	2
Semester IV								
EN010 401	Engineering Mathematics III	2	2	-	50	100	3	4
EN010 402(ME)	Principles of Management(C,M,P,L,A,T)	3	1	-	50	100	3	4
ME010 403	Hydraulic Machines	2	2	-	50	100	3	4

ME010 404	Manufacturing Process	3	1	-	50	100	3	4
ME010 405	Machine Drawing	3	1	-	50	100	3	4
ME010 406	Electrical Technology	3	1	-	50	100	3	4
ME010 407	*Hydraulic Machines Lab*	-	-	3	50	100	3	2
ME010 408	*Strength of Materials Lab*	-	-	3	50	100	3	2
Semester V								
EN010 501A	Engineering Mathematics IV	2	2	-	50	100	3	4
ME010 502	Computer Aided Design &	2	2		50	100	3	4
ME010 503	Advanced Mechanics of	3	1	-	50	100	3	4
ME010 504(EE)	Kinematics of Machinery	3	1	-	50	100	3	4
ME010 505	I.C.Engines & Combustion	3	1	-	50	100	3	4
ME010 506	Thermodynamics	3	1	-	50	100	3	4
ME010 507	*CAD/CAM Lab*	-	-	3	50	100	3	2
ME010 508(EE)	*Electrical & Electronics Lab*	-	-	3	50	100	3	2
Semester VI								
ME010 601	Mechanics of Machines	2	2	-	50	100	3	4
ME010 602	Heat & Mass transfer	2	2	-	50	100	3	4
ME010 603	Thermal Systems &	3	1	-	50	100	3	4
ME010 604	Metrology & Machine Tools	3	1	-	50	100	3	4
ME010 605	Mechatronics & Control	3	1	-	50	100	3	4
ME010 606Lxx	Elective I	3	1	-	50	100	3	4
ME010 607	Heat Engines Lab	-	-	3	50	100	3	2
ME010 608	*Machine Tools Lab*	-	-	3	50	100	3	2
Elective I								
EN010606L02	Composite material technology	2	2	-	50	100	3	4
EN010606L06	Project management	2	2	-	50	100	3	4
Semester VII								
ME010 701	Design of Machine Elements	2	2	-	50	100	3	4
ME010 702	Dynamics of Machines	2	2	-	50	100	3	4
ME010 703	Gas Dynamics & Jet	3	1	-	50	100	3	3
ME010 704	Refrigeration & Air	3	1	-	50	100	3	3
ME010 705	Industrial Engineering	3	1	-	50	100	3	3
ME010 706L04	Sales& Marketing Management	3	1	-	50	100	3	4

ME010 707	Mechanical Measurements Lab	-	-	3	50	100	3	2
ME010 708	*Advanced Machine Tools Lab*	-	-	3	50	100	3	2
ME010 709	Seminar	-	-	2	50		1	2
ME010 710	Project	-	-	1	50		1	1
Semester VIII								
ME010 801	Design of Transmission Elements	3	2	-	50	100	3	4
ME010 802	Operations Management	2	2	-	50	100	3	4
ME010 803	Production Engineering	2	2	-	50	100	3	4
ME010 804L05	Non Destructive Testing	2	2	-	50	100	3	4
ME010 805G01	Industrial Safety	2	2	-	50	100	3	4
ME010 806	Mechanical Systems Lab	-	-	3	50	100	3	2
ME010 807	Project	-	-	6	100	100	3	4
ME010 808	Viva Voce	-	-	-		50	3	2

4 Students' Performance (100)

Admission intake in the programme

Item	CAY (2014-2015)	CAY*m*1 (2013-2014)	CAY*m*2 (2012-2013)	CAY*m*3 (2011-2012)
Sanctioned intake strength of the programme (N)	120	120	120	120
Total number of students admitted in first year *minus* number of students migrated to other programmes at the end of 1st year ($N1$)	118	+ 124	+ 121	+ 117
Number of students admitted in 2nd year in the same batch via lateral entry ($N2$)	0	0	0	0
Total number of students admitted in the programme ($N1 + N2$)	118	124	121	117

4.1. Success Rate (30)

Provide data for the past seven batches of students

Year of entry (In reverse chronological order)	Number of students in 1st year + admitted via lateral entry in Second year (N1+N2)	Incomplete no of students who have successfully completed			
CAY (2014-2015)	118				
CAYm$_1$(2013-2014)	124	81			
CAYm$_2$(2012-2013)	121	95	86		
CAYm$_3$(2011-2012)	117	68	112	83	
CAY m4(LYG)(2010-2011)	90	64	39	36	41
CAY m4(LYG m1)(2009-2010)	96	62	56	58	55
CAY m4(LYGm2)(2008-2009)	63	31	21	26	30
CAY m5(LYGm2)(2007-2008)	61	39	43	36	46
CAY m4(LYGm2)(2006-2007)	58	15	16	18	26

**successfully completed implies zero backlogs*

Success rate = 30 × mean of success index (SI) for past three batches

SI= (Number of students who graduated from the programme in the stipulated period of course duration)/ (Number of students admitted in the first year of that batch and admitted in 2nd year via lateral entry)

Item	LYG (CAY*m*4)	LYG*m*1 (CAY*m*5)	LYG*m*2 (CAY*m*6)
Number of students admitted in the corresponding	90	96	63
Number of students who have graduated in the stipulated period	41	55	30
Success index (SI)	0.456	0.573	0.48

Average SI = 0.5

Success rate = 30 × Average SI = 0.5*30= 15

4.2. Academic Performance (20)

Academic Performance = 2 * API

Where API = Academic Performance Index

= Mean of Cumulative Grade Point Average of all successful Students on a 10 point CGPA System OR = Mean of the percentage of marks of all successful students / 10

Item	**LYG (CAYm4)**	**LYGm1 (CAYm5)**	**LYGm2 (CAYm6)**
Approximating the API by the following mid-point Analysis			
9 < Number of students with CGPA < 10.0	0	0	0
8 < Number of students with CGPA < 9.0	4	3	3
7<=8	25	3 3	9
6<=7	9	1 3	10
5<=6	3	6	8

Total	41	55	30
Approximating API by Mid-CGPA			
Mean of CGPA/Percentage of all the students (API)	7.23	7.1	6.73

Average API = **7.02**

Academic Performance = 2 x Av. API = 14.04

4.3. Placement and Higher Studies (30)

Assessment Points = 30 × (x + 1.25y)/N

Where, x = Number of students placed

y =Number of students admitted for higher studies with valid qualifying scores/ranks, and

N =Total number of students who were admitted in the batch including lateral entry subject to maximum assessment points = 20

Item	LYG 2010-14	LYGm1 2009-13	LYGm2 2008-12
Number of students admitted corresponding to LYG including lateral entry (N)	90	96	63
Number of students who obtained jobs as per the record of placement office (x1)	13	7	15
Number of students who found employment otherwise at the end of the final year (x2)	36	47	22
$x = x1 + x2$	49	54	37
Number of students who opted for higher studies with valid qualifying scores/ranks (y)	3	3	2
Assessment points	17.58	18.05	18.81

Average assessment points = **18.15**

4.4. Professional Activities (20)

4.4.1. Professional societies / chapters and organizing engineering events (4)

2012-2013

Inauguration of Association of Mechanical Engineers

Inaugurated by Mr. Smeer Abdul Azeez, scientist-D, Navel Physical and Oceanographic Lab. (NPOL-DRDO). Session taken by Dr. M. M Monippilly (IIM, Ahmedabad)

Dated 23-02-2013

2013-2014

Inauguration of Indian Institution of Industrial Engineering (IIIE) – Student chapter at AJCE Annual Meet of Association of Mechanical Engineers

Prof R. A. D Pillai, Former Deputy Director, VSSC and National Council member of IIIE inaugurated the IIIE chapter of AJCE.

Dated 03-04-2014

2014-2015

Workshop on Employability quotient of the student from a Global perspective'

Association of Mechanical Engineering (AME) organized a workshop by Mindprints Inc. Bangalore

Dated 20/09/14

Technical Talks

Mr. K. Manikandan, GM, Ashok Leyland delivered a talk on 'Challenges in Automotive job sector by Association of Mechanical Engineers

Dated 20/09/14

Ignition-2014

Inauguration of Association of Mechanical Engineering (AME) - IGNITION 2014 by Mr. P.S Suresh Kumar -General Manager, District Industries Centre (DIC), Kottayam on 28th August 2014 (Thursday) at 10.30 am in the College Auditorium.

Mr. P. Suresh Kumar talked about "Role of young Entrepreneurs in Indian Society" in his inaugural address motivating the young folks to be challenging citizens rather than mere degree holders in the years to come.

Talk on “Robotics"

The sessions were taken by Mr. Sunil Paul (Asst. Prof, Muthoot College of Engineering)

Dated 30-08-2014

One-day seminar on “Recent trends in Nano Composites”

The Mechanical Engineering department in association with the AJCE-ISTE chapter conducted a one-day seminar on “Recent trends in Nano Composites” The seminar was inaugurated by Dr. K Padmanabhan, Asst. Director and Head, centre for excellence in Nano composites, VIT University. Rev. Fr. Dr. Jose Kannampuzha gave the presidential address. The seminar sessions were handled by Dr. K Padmanabhan and Dr. Soney C George.

Dated 15/08/2014

Seminar on "Motivation and Professional Challenges"

The sessions were taken by Capt. George Kurian, Former Director Coal India limited by Institution Engineers India students’ chapter

Dated 01-08-2014

Seminar on “ISRO Launch Vehicles”

IEI students' Chapter of AJCE organized a seminar on the topic “ISRO launch Vehicles” on 09-04-2015. Rev. Dr. Jose Kannampuzha, Principal, Amal Jyothi college of Engineering welcomed the gathering. Er. Roshan Kuruvilla, Staff advisor IEI Students’ Chapter introduced the speaker J. Jayaprakash, Associate Director, VSSC, Thiruvananthapuram to the audience. The speaker delivered a lecture on the theme titled ‘Launch Vehicles”.

Seminar on "Propulsion through Ages

Department of Mechanical Engineering and Institution of Engineers (India) Students' Chapter organized a Technical talk on "Propulsion through Ages” by Sri Jasperlal, VSSC Trivandrum on the 28th of March 2015.

4.4.3. Publication of technical magazines, newsletters, etc. (4)

(Instruction: The institution may list the publications mentioned earlier along with the names of the editors, publishers, etc.).

(Instruction: The institution may specify the efforts and achievements.)

Name of news-letter/magazine	Volume No	Month & year of publishing	Editor	Publisher
Yanthrik	I	2013		Mechanical Engineering Department
MESSENGER (bi-annual newsletter)	1	January 2015		Mechanical Engineering Department
MESSENGER (bi-annual newsletter)	2	June 2015		Mechanical Engineering Department

Efforts and achievements

4.4.4. Entrepreneurship initiatives, product designs and innovations (4)

(Instruction: The institution may provide data of the past three years).

Innovations

Students are encouraged to do various projects which include original innovation. They are made to choose an area of their interest, identify critical problems in their chosen area and come out with original and innovative ideas as solutions to these problems. Many student projects have been receiving funding from the college and various other agencies

Funded/Sponsored Projects:

Sanctioned/ Proposals submitted

Project Title	*Amount*	*Agency*
ECAP for Nuclear application	37 Lakh	BRNS, DAE India
Robot for Bore Well Rescue	15 Lakh	DST, Govt. of India
Rice Noodle maker with continuous production unit	1.36 Lakh	KSCSTE, Govt. of Kerala
Soil Mithra	1 Lakh	DST, Govt. of India
Pepper separator	1 Lakh	DST, Govt. of India
Cardamom drier	1 Lakh	DST, Govt. of India
Table top power operated coconut husker	1 Lakh	DST, Govt. of India

Patient Transfer Board	20000	State Commissioner for persons with Disability, Govt. of Kerala
Economic Fuel Consuming Vessel	20000	AJCE, I ^{2}U
Navigator under water search equipment	20000	AJCE, I^{2}U
Charged Belt Separator for domestic waste	20000	AJCE, I^{2}U
Complete LPG Leak Protection System	20000	AJCE, I^{2}U
Conical Pepper Threshing machine	20000	AJCE,I^{2}U
Intelligent Duster	20000	AJCE, I^{2}U
Automatic Lemonade machine	20000	AJCE, I^{2}U
Human hair reinforced bio-composite	20000	AJCE, I^{2}U
Design and development of composite eco-wood and derived products from Eichronia Crassipes and coir pith	20000	AJCE, I^{2}U
Effect of welding parameters on microstructure and mechanical properties on friction – stir welding on aluminum alloys	20000	AJCE, I^{2}U
Design of a small scale paper recycling unit	20000	AJCE, I^{2}U
Ergonomic Waste Compactor	20000	AJCE I^{2}U

4.4.5. Publications and awards in inter-institute events by students of the programme of study (4)

(Instruction: The institution may provide a table indicating those publications, which received awards in the events/conferences organized by other institutes. A tabulated list of all other student publications may be included in the appendix.)

Publications and awards in inter institute events by students

Students are encouraged to participate in various conferences and present their project works. Students have come out with flying colors in many of these events. Few such publications during 2014-15 are listed below

Sl. #	Name of the student	Name of Faculty	Centre where the project is carried out	Project Topic	Details of International/National Conferences Attended/ Published
1	Alok Tom, Geo Mathew Pius, George Joseph, Jacob Jose	Mathew J Joseph	Amal Jyothi College of engineering	Design and analysis of LPG cylinder	International journal of engineering and applies sciences, Vol 6, issue 2, 2014, page 17-31
2	Paulson Varghese, Febin Joseph, Merrin	Dr. Kurien Antony	Amal Jyothi College of Engineering	The Effect of Repeated Repair Welding on the Corrosion Behavior of Austenitic steel	Proceedings of International Conference on Advances in Materials, 2014
3	John Varkey, and A. Sreekanth			Stainless Steel and Mild Steel Dissimilar Weldment	Manufacturing and Applications (AMMA 2015), April 9-11, 2015
4	Sebin Sabu, Nikhil Jacob George, Tom Alphonse Antony	Ashwin Chandy Alex	Amal Jyothi College of Engineering	Design and Modelling of a Pelton Wheel Bucket	International Journal of Engineering Research & Technology, Vol. 3 - Issue 3 (March - 2014)
5	Sebin Sabu, Nikhil Jacob George, Tom Alphonse Antony	Ashwin Chandy Alex	Amal Jyothi College of Engineering	Static Analysis On Pelton Wheel Bucket	International Journal of Engineering Research & Technology, Vol. 3 - Issue 3 (March - 2014)
6	Sebin Sabu, Nikhil Jacob George, Tom Alphonse Antony	Ashwin Chandy Alex	Amal Jyothi College of Engineering	Design and Force Analysis of Camera Jib Crane	International Journal of Engineering Research & Technology, Vol. 3 - Issue 3 (March - 2014)

Achievements by B. Tech. Students

Notable achievements by B. Tech. students during the past two academic years are listed in the following Table.

Name of the Student	Prize	Category	Event	College
2013-2014				
Ajin George	First	Cultural	Freedo Weirdo	Crossroads, MBCOE, Trivandrum
Anson Mathew	First	Cultural	Freedo Weirdo	Crossroads, MBCOE, Trivandrum
Joel P Jacob	First	Tech	Mech Quiz	Maquina, Musaliar
Clint T C	First	Cultural	Run A Muck	Crossroads, MBCOE, Trivandrum
Jes Thomas Mathew	Second	Tech	Concept PPT	Nakshatra, Saintgits
Tomin Jose	First	Tech	Aqua Rocket	Nakshatra, Saintgits
Alex Paul Joseph	First	Tech	Aqua Rocket	Nakshatra, Saintgits
Philip Christy	Second	Tech	Concept PPT	Nakshatra, Saintgits
Sachin Jose	First	Tech	Aqua Rocket	Nakshatra, Saintgits
Christy George John	First	Tech	Ethinicity	Nakshatra, Saintgits
Atul Hari	First	Tech	Step Up	Nakshatra, Saintgits
Justin J	Second	Tech	Mega Event	Swastika, MBC Peermade
Visakh G	First	Tech	CAD Drawing	Nakshatra, Saintgits
Abin K Prasad	First	Tech	Circuit Debugging	Nakshatra, Saintgits
Shinu P Jose	Third	Sports	SZ BB Third	MGU, Kottayam
Shone Shaj	Third	Sports	SZ BB Third	MGU, Kottayam
Alwin Regi Varghese	First	Tech	PP - 1st	
Ansen H Mathew		NSS	Attended Conferences	
Clint T C	First	Tech	PP - 1st	
Joel P Jacob	Third	Sports	SZ BB Third	MGU KOTTAYAM
Sarath T Joy	First	Sports	TT-1	MGU KOTTAYAM
Antony V Patrick	Third	Sports	SZ BB Third	MGU KOTTAYAM
Binu Shaji Ninan	Third	Sports	SZ BB Third	MGU KOTTAYAM
Cherian Philip	Third	Sports	SZ BB Third	MGU KOTTAYAM
Jeswin Jose	First	Angry Bots - Robo War	Fotios, Caarmel	Carmel Engineering College
2014-2015				
Siby Balu	Second	Arts/tech	Best project	Infocom Kolkata
Jes Thomas Mathew	Second	Arts/tech	Best project	Infocom Kolkata
Mahesh Satheesan	Second	Arts/tech	Best project	Infocom Kolkata
Akhil Ravi	First	Arts/tech	Conco dance	Echose IIM Kozhikode
Anand S Thopil	First	Arts/tech	Conco dance	Echose IIM Kozhikode

Athul Hari	First	Arts/tech	Conco dance	Echose IIM Kozhikode
Basith C K	First	Arts/tech	Concordance	Echose IIM Kozhikode
Alan Saji George	First	Arts/tech	Concordance	Echose IIM Kozhikode
Amal Linus	First	Arts/tech	Western solo	Ragam NIT Calicut
Sachin Jose	Best innovation award	Arts/tech	Project presentation	Srishti SAINTGITS
Alex Paul Joseph	Best project award	Arts/tech	Project expo	Srishti SAINTGITS
Jibin Chacko Thomas	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Sanju Jose	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Tony Joseph	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Samjo K	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Abin T Alex	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Litto Tom	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Manu Thomas Tom	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Jerry T Thanjath	Final round	Arts/tech	Project exhibition	Srishti SAINTGITS
Sooraj Kulangara Abraham	First	Arts/tech	Project expo	Torque Mangalam
Mukundan R	First	Arts/tech	Autoquiz	Adharwa COE Punnapra
Alexander George	First	Arts/tech	Autoquiz	Adharwa COE Punnapra
Sharath V Joy	First	Arts/tech	Autoquiz	Adharwa COE Punnapra
Deepu George	First	Arts/tech	Autoquiz	Adharwa COE Punnapra
Aby Mathew	First	Arts/tech	Junckyard war	Asthra SJCE Pala
Rony Philip	First	Arts/tech	Aqua missile	Asthra, SJCE Pala
Jerin K Job	First	Arts/tech	Scrap assembly	Asthra, SJCE Pala
Jessin Jose	First	Arts/tech	Scrap assembly	Asthra, SJCE Pala
Don Mathew	First	Arts/tech	Auto quiz	Asthra, SJCE Pala
Justin J	First	Arts/tech	Aqua missile	Asthra, SJCE Pala
Jeswin Jose	First	Arts/tech	Lathemaster	Avishkar, Musliar
Joyal P Jacob	First	Arts/tech	3x3 basket ball	Avishkar, Musliar
Ajal Abraham	First	Arts/tech	Junkyard war	Genesis SCMS
Alvin Reji Varghese	First	Arts/tech	Junkyard war	Genesis SCMS
George Koshi	First	Arts/tech	Junkyard war	Nakshatra, SAINTGITS

Ijas mohemmed	First	Arts/tech	Lathemaster	Nakshatra, SAINTGITS
Ashish A	First	Arts/tech	Slip soccer	Nakshatra, SAINTGITS
Febin Thomas	First	Arts/tech	Slip soccer	Nakshatra, SAINTGITS
Anand Krishnan R	First	Arts/tech	Slip soccer	Nakshatra, SAINTGITS
Amith S Gopal	First	Arts/tech	Sherlockholmes	Nakshatra, SAINTGITS
Anandu Devan	First	Arts/tech	Sherlockholmes	Nakshatra, SAINTGITS
Jeswin Thomas George	First	Arts/tech	Best artist	Nakshatra, SAINTGITS
Jacob Philip	First	Arts/tech	3x3 football	Nakshatra, SAINTGITS
Brolin v kuruvila	First	Arts/tech	Best engineer	Nakshatra, SAINTGITS
Amal Mathew	First	Arts/tech	Best comedian	Nakshatra, SAINTGITS
Varun S	First	Arts/tech	3x3 basket ball	Nakshatra, SAINTGITS
Noel Mendez	First	Arts/tech	3x3 basket ball	Nakshatra, SAINTGITS
Tomin Jose	First	Arts/tech	3x3 basket ball	Nakshatra, SAINTGITS
Rohith Joseph	First	Arts/tech	3x3 basket ball	Nakshatra, SAINTGITS
Justin C Jose	First	Arts/tech	Cad drawing	Nakshatra, SAINTGITS
Christy George John	First	Arts/tech	Junkyard war	Nakshatra, SAINTGITS
Joel Thomas	First	Arts/tech	CAD competition	Rithu RIT
Robin P Dominic	First	Arts/tech	CAD competition	Rithu RIT
Allen J Earathu	First	Arts/tech	Pits top	SAINTGITS
Justin Jacob	First	Arts/tech	CAD competition	Swasthika MBC
Clint T C	First	Arts/tech	My gang	Swasthika MBC
Sen Lalu Alex	First	Arts/tech	My gang	Swastika, MBC
Vishak R	First	Arts/tech	Best manager	Swastika, MBC
Mohammed Anshed	First	Arts/tech	Network gaming	Swastika, MBC
Siby Balu	First	Arts/tech	Project expo	Torque Mangalam
Chahat k a	First	Arts/tech	Mr Mechanic	Torque Mangalam
Abin K Prasad	First	Arts/tech	Mr Mechanic	Torque Mangalam
Visakh G	First	Arts/tech	Ardhasamhitha	Vivid St Thomas COE Chengannur
Visakh G	First	Arts/tech	Frugalmaestro	Vivid St Thomas COE Chengannur
Jofin Varghese	First	Arts/tech	Ardhasamhitha	Vivid St Thomas COE Chengannur
Jofin Varghese	First	Arts/tech	Frugalmaestro	Vivid St Thomas COE Chengannur

Ansen h Mathew	First	Arts/tech	Mr and Ms Tezoro	Tezoro, TKM
Toms George	Second	Arts/tech	Evhizz	Asthra SJCE Pala
John Tommy Akkara	Second	Arts/tech	CAD competition	Nakshatra, SAINTGITS
Jaison C V	Second	Arts/tech	3x3 basket ball	Nakshatra, SAINTGITS
Sharon Rony Jacob	Second	Arts/tech	Paper presentation	Nakshatra, SAINTGITS
Jaison c v	Second	Arts/tech	3x3 basket ball	Nakshatra, SAINTGITS
John Paul	Second	Arts/tech	Cognito	Rithu RIT
Paul Joe Mampilly	Second	Arts/tech	Cognito	Rithu RIT
Avin James	Second	Arts/tech	C debugging	Swasthika MBC
Amal Shaju	Second	Arts/tech	C debugging	Swasthika MBC
Avin James	Third	Arts/tech	C debugging	Nakshatra, SAINTGITS
Benson Kuruvilla	Third	Arts/tech	Concept ppt	Nakshatra, SAINTGITS
Alex K Babu	Third	Arts/tech	Concept ppt	Nakshatra, SAINTGITS
Amal Shaju	Third	Arts/tech	C debugging	Nakshatra, SAINTGITS
Vishnu surendran	First	Sports	Chess tournament	Newman college, Thodupuzha
Vivek Tom Abraham	First	Sports	Volleyball tournament	MBC Trophy
Ren Cherian	First	Sports	Volleyball tournament	MBC Trophy
Aby Cherian	First	Sports	Volleyball tournament	MBC Trophy
Abin T Alex	First	Sports	Volleyball tournament	MBC Trophy
Rahul Binu Mathew	Second	Sports	Table tennis	St Alberts college
Sarath V. Joy	Second	Sports	Table tennis	St Alberts college
Subin Sunny	Second	Sports	Badminton	Pace, SJCE, Pala
Jayakrishnan T.J	Second	Sports	Badminton	Pace, SJCE, Pala
Sanal Iype John	Second	Sports	Badminton	Pace, SJCE, Pala
Amal Thomas Joseph	Second	Sports	Badminton	Pace, SJCE, Pala
Dennis Joseph	Third	Sports	Basketball tournament	Model Engg College
Augustin Franson	Third	Sports	Basketball tournament	Model Engg College
Jaison C. V	Third	Sports	Basketball tournament	Model Engg College
Shone Shaj	Third	Sports	Basketball tournament	Model Engg College
Joel P Jacob	Third	Sports	Basketball tournament	Model Engg College
Irfan	Third	Sports	Basketball tournament	Model Engg College
Shinu P. Jose	State camp	NSS		
Sidharth Mathew	State camp	NSS		
Midhun Babu k	State camp	NSS		

Lijo Jose	State camp	NSS		
Vishnu Lakshmanan	State camp	NSS		
Sherin Thomas	State camp	NSS		
Toms George	State camp	NSS		
Dony Joseph	Participation + prize + publication	W/c	Recent advances in polymer technology	MGU Kottayam
Jobin Joseph k	Participation	W/c	Line follower robot comptn	IIT Bombay
Sharath chandran	Participation	W/c	Line follower robot comptn	IIT Bombay
Sharon Thomas	Participation	W/c	Line follower robot comptn	IIT Bombay
Rahul Rajeev	Participation	W/c	Line follower robot comptn	IIT Bombay
Dennis Noble	Representati on	W/c	Mun	MA College
Ebenezer G Alex	Representati on	W/c	Mun	MA College
Alan victor Alfred Raju	Representati on	W/c	Mun	MA College
Edwin Tomy	Representati on	W/c	Mun	MA College
Richu J Babu	Participation + prize+ publication	W/c	Recent advances in polymer technology	MGU Kottayam
Sony Mathew	Participation + prize+ publication	W/c	Recent advances in polymer technology	MGU Kottayam
Arun M Nair	Participation + prize+ publication	W/c	Recent advances in polymer technology	MGU Kottayam
Alan victor Alfred Raju	Participation + prize+ publication	W/c	Recent advances in polymer technology	MGU Kottayam
Jayakrishnan T J	Participation + prize+ publication	W/c	Recent advances in polymer technology	MGU Kottayam
Jerry J Thanchath	First	Arts/tech	Yanthra	Mechnius 2014; Saintgits
Jessin Jose	First	Arts/tech	Yanthra	Mechnius 2014; Saintgits
Alan Saji George	First	Arts/tech	Junkyard wars	Mechnius 2014; Saintgits
Brolin Kuruvilla	First	Arts/tech	Ultimate royal event	Mechnius 2014; Saintgits

Jeswin Thomas George	First	Arts/tech	Real steel	Sferics; Saintgits
Joel P Jacob	First	Arts/tech	Real steel	Sferics; Saintgits
Jobit joy Abraham	First	Arts/tech	Lathe master	Mechnius 2014; Saintgits
Vishak R	First	Arts/tech	Lathe master	Mechnius 2014; Saintgits
Rony Philip	First	Arts/tech	Lathe master	Mechnius 2014; Saintgits
Manu Thomas Tom	First	Arts/tech	Lathe master	Mechnius 2014; Saintgits
Anandu Devan	First	Arts/tech	Pitstop	Mechnius 2014; Saintgits
Justin C Jose	First	Arts/tech	Brain storm	Mechnius 2014; Saintgits
Abin T Alex	First	Arts/tech	Brain storm	Mechnius 2014; Saintgits
Ajith Somanathan	Second	Arts/tech	Brain storm	Mechnius 2014; Saintgits
Don Paul	Second	Arts/tech	Brain storm	Mechnius 2014; Saintgits
Richu J Babu	Certificate of recognition+ 3rd	Arts/tech	All Kerala innovators meet	The headline; Takshak; MACE
Sony Mathew	Certificate of recognition+ 3rd	Arts/tech	All Kerala innovators meet	The headline; Takshak; MACE
Sharon Rony Jacob	Certificate of recognition+ 3rd	Arts/tech	All Kerala innovators meet	The headline; Takshak; MACE
Philip Thomas	Certificate of recognition+ 3rd	Arts/tech	All Kerala Innovators meet	The headline; Takshak; MACE
Christy C John	First	Arts/tech	Robowar	Mechnius 2014; Saintgits
George Koshy	First	Arts/tech	Robowar	Mechnius 2014; Saintgits
Basith C K	First	Arts/tech	Ultimate royal event	Mechnius 2014; Saintgits
Abin K Prasad	First	Arts/tech	The machinist	Mechnius 2014; Saintgits
Atul Hari	First	Arts/tech	Junkyard wars	Mechnius 2014; Saintgits
Sen Lalu Alex	First	Arts/tech	The machinist	Mechnius 2014; Saintgits
Chahat K A	First	Arts/tech	Pitstop	Mechnius 2014; Saintgits
Clint T C	Certificate Of Participation	ARTS/TECH	New Business Planning And Management	Nippon Kerala Centre, Kochi
Jerrin K Job	First	Arts/tech	Yanthra	Mechnius 2014; Saintgits
Vishnu Surendran		Sports		Chess VIT
Rahul Binu Mathew		Sports		Chess VIT
Sarath T. Joy		Sports		Chess VIT
Sherin Thomas	NSS	NSS	State level	State level workshop

5. Faculty Contributions (175)

List of Faculty Members: For the programme exclusively / Shared with other programmes

(Instruction: The institution may complete this table for the calculation of the student-teacher ratio (STR). Teaching loads of the faculty member contributing to the undergraduate programme only (2nd, 3rd, and 4th year) are considered to calculate the STR.)

Name of the faculty member	Qualification, university, and year of graduation	Designation and date of joining the institution	Distribution of teaching load (%)			Number of research publications in journals and conferences since joining	IPRs	R&D and consultancy work with amount	Interaction with outside world
			1st Year	UG	PG				
K .Sreekumar	ME Met IISC 1987, B. Tech. Met BHU 1974, BSc Chemistry KU 1970.	Prof.2012 July		100		Nil	Nil	Nil	Different R&D groups like ISRO, DRDO, Midhani.
K. P Sunderswaran	B Sc (Engg) (Mechanical) in first class with honours of Calicut University, from R E C,Calicut (1968-1972) M Tech(Industrial Engg) in first class from IIT, Madras(1975-1977) DHRM of IGNOU(1992) German G1 Level of Max Mueller Bhavan, Madras(1980)	Prof. 2002 October		100		Nil	Nil	Nil	continuous association with unique non-governmental organization and other industrial houses in service/logistics/manufacturing areas

Binu Thomas	M. Tech– Manufacturing Technology-NIT Calicut B. Tech – Mechanical Engineering – MGU Kottayam	Asst Prof 2005	63	37		1 Int. conf./2 Nat. conf.	Nil	Nil	Life member ,ISTE (LM 65415)
Toms Philip	M.E – Engineering Design – Bannari Amman Institute of Technology, Sathyamangalam (2004 – 2006) B. Tech Mechanical , School of Engineering, CUSAT. (1997-2001)	Asst Prof 28/8/2006	73.33		26.67	4	Nil	Nil	Life member ,ISTE
Jibin C Jacob	M. Tech NIT CALICUT 2013 B. Tech Calicut University 2007	Asst. Prof 2008	31.25	68.75		NIL	NIL	BRNS PROJECT ON ECAP as Coinvestigator	
Arun K Sukumaran	M. Tech– Thermal Science – Kerala University, Thiruvananthapuram (November 2009) B. Tech –Mechanical Engineering –Kannur University, Kannur (May 2003)	Asst. Prof 11/1/2010		100		1	Nil	Nil	Nil
Tenny Thomas	M Tech - NIT Calicut -2008-2010 B. Tech.- Kerala University-2004-2008	Asst. Prof 18-06-2010		100		1	Nil	Nil	Nil
Ajosh Abraham	B. Tech Mechanical Engineering, Govt. RIT Kottayam M Tech NIT Calicut	Asst. Prof 28-12-2009	12.5	87.5		Nil	Applied	Nil	Nil

Arjun K. R	M. Tech- MGU KOTTAYAM,2012 B. Tech-MGU KOTTAYAM-2008	Asst. Prof 07-07-2008		100		3	Nil	Nil	Nil
Roshan Kuruvilla	B.E: Mangalore University M Tech: CUSAT MBA: IGNOU	Asst. Prof 12/7/2010		100		1	Nil	Nil	continuous association with Professional Societies like Institution of Engineers, Indian institute of Production Engineers, Indian Engineering & Technology etc
Richu Thomas	B. Tech: MG University M. Tech: Hindustan University	Asst. Prof		50	50	1	Nil	Nil	
Mathew J Joseph	M. Tech Manufacturing Technology NIT Calicut 2012, B. Tech University of Kerala 2009	Asst. Prof 02-07-2012	50	50		2		Nil	As part of activities of ISTE AJCE chapter, interactions with various institutions and Resource persons all over India.
Rakesh R	M Tech Engineering Design; Amrita University 2012; B. Tech. MGU KOTTAYAM 2008	Asst. Prof 15-12-2008	33	34	33	3	Nil	Nil	Project Proposal submitted to DRDO
Abu Mani	M.E production Engineering - 2011-2013 PSG College of Technology, B-Tech-St Joseph's college of Engineering and Technology-2006-2010	Asst. Prof 01-07-2013	33%	67%		1	Nil	Nil	Nil

Francis K	ME Industrial Engineering and Management 2011-2013 batch Nit Calicut , B. T ech, 2006-10,Kerala University	Asst. Prof 03-07-2013	33%	67%		Nil	Nil	Nil	Nil
Meby Mathew	M.E Manufacturing Systems Management Anna University CEG(2011-2013) B.Tech Mechanical Engineering Amal Jyothi College of engineering (2007-2011)	Asst. Prof 08/07/2013		75	25	1			
Ashwin Chandy Alex	M. Tech - Machine Design - Saintgits College of Engineering - 2010-2012, B. Tech -MGU KOTTAYAM- 2004-2008	Asst. Prof- 07/07/13	15	45	40	4	Nil	Nil	Nil
Rony Thomas Murickan	M Tech, VIT University, 2013, B. Tech Mechanical Engineering - MGU Kottayam	Asst. Prof 15/07/2013	31.25	68.75		1 International Journal and 1 National Journal	Nil	Nil	Nil
Bini Koshy Varghese	M Tech, VIT University, 2013	Asst. Prof, 01.08.13	17.67	35.29	47.05	1	0	Nil	Nil
Tony Varghese	M Tech, CET Trivandrum, 2013	Asst. Prof, 23.08.13		100		2		5.7lakhs	

Subin P George	MS in Engineering Design IITM 2012 , B. Tech.in Mechanical Engg from Kerala university(2007)		33	34	33	1	2(filed)	BRNS PROJECT ON ECAP as Co Invesigator (45 Lakhs), Funded Project from KSCTE(1.2 Lakhs) and Kerala State Commisionerate for Persons with Disabilities(Rs 20,000)	Active involvement in Product development for Rehabilitation, Collaboration with TKM college on Research in Biomechanics
Tom Sunny	M Tech, SJCET, Palai,2013 B. Tech, MBCCET, 2010	Asst. Prof, 15.01.14	31.25%	68.75%	Nil	2	2	Nil	
Dr Kurian Antony	Ph.D-2014,M.E-2010,B.E-2008	Asst. Prof 27-06-2014		100		2 Int Journals/ 2 Int conference		40 lakhs	Life member of Additive manufacturing society of India -AM-182/15
Richu Zachariah	M Tech-Energy Engineering-NIT Trichy -2014 B. Tech.- M.G.U - 2012	Asst. Prof 01-07-2014	53.33	20	26.67	Nil			
Sherin Thampi	ME -GEC SALEM (Anna university, Chennai)-2014 B. Tech Kerala university -2011	Asst. Prof 01-07-2014	31.25%	68.75%		Nil			

Manu Moses Jacob	M. Tech - NIT Calicut 2014 B. Tech - MGU KOTTAYAM - 2011	Asst. Prof 01-07-2014		100		Nil			
Vipin Vijayan	M Tech. 2014, B. Tech.2010	Asst. Prof 1/8/2015	63	37		1			
Abi Varghese	M Tech. 2014, B. Tech.2012	Asst Professor 01/01/2015		100		2		One Lakhs DST Govt. of India	
Amal Saji Kumar	M Tech. 2014, B. Tech.2012	Asst. Prof 01/01/2015	12	88		1			
George Sebastian	M Tech. 2013, B. Tech.2011	Asst. Prof 28/01/2015	0	100	0	0	Nil	Nil	Nil
Saju Sebastian	M.E Anna University CEG (2011-2013) B. Tech Mechanical -St Joseph's college of Engineering and Technology-2006-2010	Asst. Prof-01/01/2015	33	67		0	Nil	Nil	Nil

5.1. Student- Teacher Ratio (STR) (20)

STR is desired to be 15 or superior

Assessment = 20 × 15/STR; subject to maximum assessment of 20

STR = $(x + y + z)/N1$

Where, x = Number of students in 2nd year of the programme

y = Number of students in 3rd year of the programme

z = Number of students in 4th year of the programme

$N1$ = Total number of faculty members in the programme (by considering fractional load)

Year	x	Y	z	$x + y + z$	$N1$	STR	Assessment (Max. = 20)
CAY$m2$	119	93	98	310	33	9.39	20
CAY$m1$	120	117	93	330	27	12.22	20
CAY	125	119	117	361	36	10.03	20
						Average assessment	20

N = Maximum $\{N1, N2\}$
$N1$ = Total number of faculty members in the programme
(considering the fractional load)
$N2$ = Number of faculty positions needed for student-teacher ratio of 15

Year	$N1$	$N2$	N = Max. ($N1$, $N2$)
CAY$m2$	33	20.67	33
CAY$m1$	27	22	27
CAY	36	24.07	36

5.2 *Faculty Cadre Ratio (20)*

For item nos. 5.2 to 5.8, the denominator term (N) is computed as follows:

Assessment = 20 × CRI

Where, CRI = Cadre ratio index

= 2.25 × $(2x + y)/N$; subject to max. CRI = 1.0

where, x = Number of professors in the programme

y = Number of associate professors in the programme

Year	X	y	N	CRI	Assessment
CAY$m2$	5	0	33	0.68	13.6
CAY$m1$	3	0	27	0.5	10
CAY	5	0	36	0.625	12.5
Average assessment					**12.03**

5.3 Faculty Qualifications (30)

Assessment	=	4 × FQI
where, FQI	=	Faculty qualification index
	=	$(10x + 6y + 2z_0)/N2$ such that, $x + y + z_0 \leq N2$; and $z_0 \leq z$
where, x	=	Number of faculty members with PhD
y	=	Number of faculty members with ME/ M Tech
z	=	Number of faculty members with B.E/B. Tech

	x	y	z	N	FQ	Assessment
CAY$m2$	3	27	3	33	9.58	38.32
CAY$m1$	2	22	3	27	7.18	28.72
CAY	4	32	0	36	9.64	38.56
	Average assessment					**35.27**

5.4. Faculty competencies in correlation to Programme Specific Criteria (15)

(Provide evidence that programme curriculum satisfies the applicable programme criteria specified by the appropriate American professional associations such as ASME, IEEE and ACM. You may list the programme specific criteria and the competencies (specialization, research publications, course developments etc.,) of faculty to correlate the programme specific criteria and competencies.)

The faculty of Mechanical Engineering Department are competent in the core areas of B-Tech Programmes as required by the Programme Specific Criterion.
The following Table shows the different core areas and the faculty members associated with each of the core areas

Area	Faculty
Farm Machinery	Rev Dr Jose Kannampuzha, Dr Jippu Jacob
Machine design	Toms Phillip, R Rakesh, Aswin Chandy Alex, Tony Varghese, Subin P George, Abi Varghese

Manufacturing & production	Dr Kurien Antony, Binu Thomas, Roshan Kuruvila, Mathew J Joseph, Abu Mani, Meby Mathew, Rony T Muriken, Tom Sunny, Vipin Vijayan, George Sebastien
Energy Engineering	Richu Zachariah, Ajosh Abraham
Thermal Engineering	Arun K Sukumaran, Amal Sajikumar
Industrial Engineering	K.P Sundhareswaran, Arjun K.R, Tenny Thomas, K. Francis
Material science and metallurgy	K Sreekumar, Jibin C Jacob, Manu Moses Jacob,
Welding Technology	Sherin Thambi
Aeronautical Engineering	Richu Thomas
IC engineering	Saju Sebastien
Mechatronics	Bini Koshi Varghese

5.5. Faculty as participants/resource persons in faculty development/training activities (15)

(Instruction: A faculty member scores maximum five points for a participation/resource person.)

Participant/resource person in two week faculty development Programme: 5 points
Participant/resource person in one week faculty development Programme: 3 Points

Name of the faculty	Max. 5 per faculty		
	CAY*m*2	CAY*m*1	CAY
Arjun K. R	5	5	
Richu Thomas	5		
Mathew J Joseph	5		
Rakesh R	5		
Meby Mathew	3		

Rony Thomas Murickan	3	3	
Tony Varghese	5	5	
Sum	31	13	0
N (Number of faculty positions required for an STR	33	27	36
Assessment = 3 × Sum/N	2.82	1.44	0
Average assessment			**1.42**

5.6. Faculty Retention (15)

Assessment = 3 × RPI/N
where RPI = Retention point
= Points assigned to all faculty members

Where points assigned to a faculty member = 1 point for each year of experience at the institute but not exceeding 5.

Item	CAYm2	CAYm1	CAY
Number of faculty members with experience of less than 1 year (x_0)	6	7	9
Number of faculty members with 1 to 2 years of experience (x_1)	5	3	9
Number of faculty members with 2 to 3 years of experience (x_2)	7	2	2
Number of faculty members with 2 to 3 years of experience (x_3)	7	4	2
Number of faculty members with 4 to 5 years of experience of less than 1 year (x_4)	1	4	3
Number of faculty members with more than 5 years of experience (x_5)	7	7	11
N	33	27	36
RPI = $x_1 + 2x_2 + 3x_3 + 4x_4 + 5x_5$	79	70	86
Assessment	7.18	7.78	7.17
Average assessment			**7.38**

5.7. Faculty Research Publications (FRP) (20)

Assessment of FRP = 4 × (Sum of the research publication points scored by each faculty member)/*N*

(Instruction: A faculty member scores maximum five research publication points depending upon the *quality* of the research papers and books published in the past three years)

The research papers considered are those (i) which can be located on the internet and/or are included in hard-copy volumes/proceedings, published by reputed publishers, and (ii) whether the faculty member's affiliation, in the published papers/books, is of the current institution.

Include a list of all such publications and IPRs along with details of DOI, publisher, month/year, etc.

List of Journal Publications from Mechanical faculty after joining AJCE

1. Kurian Antony, Siva Prasad M. A Comparison of Corrosion Resistance of Stainless Steel Fabricated with Selective Laser Melting and Conventional Processing" International Journal of Chem Tech Research, Vol.7, No.6, 2015
2. Subin P George, & Saravana Kumar, G. Patient specific parametric geometric modelling and finite element analysis of cementless hip prosthesis. Virtual and Physical Prototyping, 0(0), 1–19. doi:10.1080/17452759.2012.755654
3. Naresh Kumar Gurusala1, a *, Richu Zachariah, b and Arul Mozhi Selvan V1, c Effect of EGR on Combustion and Emissions Characteristics of a CI Engine Fuelled with Waste Chicken Fat Biodiesel Applied Mechanics and Materials Vols. 592-594 (2014) pp 1481-1486© (2014) Trans Tech Publications, Switzerland
4. Ajithmon Anto, Bini Koshy Varghese, DESIGN AND STRESS ANALYSIS OF A SIMPLIFIED CREEP TESTING MACHINE, International Journal of Advance Engineering and Research Development ISSN (Print) : 2348-6406 ISSN (Online): 2348-4470
5. ABI VARGHESE, JIPPU JACOB, A REVIEW OF COCONUT HUSKING MACHINES, INTERNATIONAL JOURNAL OF DESIGN AND MANUFACTURING, TECHNOLOGY (IJDMT) ISSN 0976 – 6995 (Print) ISSN 0976 – 7002 (Online)Volume 5, Issue 3, September - December (2014), pp. 68-78
6. Rony Thomas Murickan, Kuppan P and Lakshmi Pathi J (2013) A REVIEW ON DRY EDM AND NEAR-DRY EDM PROCESSES, ‚Journal of Manufacturing Engineering, June, 2013, Vol. 8, Issue. 2, pp 196-199
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Name of the faculty (contributing to FRP)	FRP points (max. 5 per faculty)		
	CAY$m2$	CAY$m1$	CAY
Kurian Antony	2	5	2
Rakesh Reghunath	1	1	
Richu Zachariah		1	
Vipin Vijayan	1	1	
Tom Sunny	4	4	
Rony Thomas Murickan	4		
Ashwin Chandy Alex	1	4	
Amal Sajikumar		1	
Tony Varghese	1	2	
Sherin Thampi		2	
Mathew J Joseph		1	
Manu Moses Jacob		1	
Abu Mani		1	
Francis K		1	
Meby Mathew		1	
Binu Thomas		3	
Arjun.K.R	1	1	1
Jippu Jacob , Abi Varghese		2	
Sum	15	32	3
N (Number of faculty positions required for an STR of 15)	33	27	36
Assessment of FRP = 4 × Sum/N	1.82	4.74	0.33
		Average assessment	**2.30**

5.8. Faculty Intellectual Property Rights (FIPR) (10)

Assessment of FIPR = 2 × (Sum of the FIPR points scored by each faculty member)/N

(Instruction: A faculty member scores maximum five FIPR points year? FIPR includes awarded national/international patents, design, and copyrights.)

Name of faculty member (contributing to FIPR)	FIPR points (max. 5 per faculty member)		
	CAYm2	CAYm1	CAY
Sum	0	0	0
N	33	27	36
Assessment of FIPR = 2 × Sum/N	0	0	0
Average assessment			0

5.9 Funded R&D Projects and Consultancy (FRDC) Work (20)

Assessment of R&D and Consultancy projects = 4 × (Sum of FRDC by each faculty member)//N
(Instruction: A faculty member scores maximum 5 points, depending upon the Amount.)
A suggested scheme is given below, for a minimum amount of Rs. 1 lakh:
Five points for funding by national agency, four points for funding by state agency/ private sector, two points for funding by the sponsoring trust/society.

Name of faculty member (contributing to FRDC)	FRDC points (max. 5 per faculty		
	CAYm2	CAYm1	CAY
Dr Kurian Antony.			5
Subin P George			4
Dr Jippu Jacob	5		
Jibin C Jacob			5
Arjun K. R		4	
Sum	5	4	14
N	33	27	36
Assessment of FRDC = 4 × Sum/N	0.61	0.60	1.56
	Average assesment		**0.92**

Funded R & D Projects

Project Title	*Amount*	*Agency*
ECAP for Nuclear application	37 Lakh	BRNS, DAE India
Robot for Bore Well Rescue	15 Lakh	DST, Govt. of India
Rice Noodle maker with continuous production unit	1.36 Lakh	KSCSTE, Govt. of Kerala
Soil Mithra	1 Lakh	DST, Govt. of India
Pepper separator	1 Lakh	DST, Govt. of India
Cardamom drier	1 Lakh	DST, Govt. of India
Table top power operated coconut husker	1 Lakh	DST, Govt. of India
Patient Transfer Board	20000	State Commissioner for persons with Disability, Govt. of Kerala

5.10. Faculty interaction with outside world (10)

FIP = Faculty interaction points

Assessment = 2 × (Sum of FIP by each faculty member)/N

(Instruction: A faculty member gets maximum five interaction points, depending upon the type of institution or R&D laboratory or industry, as follows)

Five points for interaction with a reputed institution abroad, institution of eminence in India, national research laboratories.

Three points for interaction with institution/industry (not covered earlier).

Points to be awarded, for those activities, which result in joint efforts in publication of books/research paper, pursuing externally funded R&D / consultancy projects and/or development of semester-long course / teaching modules.

Name of faculty member (contributing to FIP)	FIP		
	CAYm2	CAYm1	CAY
Dr Kurian Antony			3
Mr Sreekumar K			3
Dr. Jippu Jacob	3	3	3
Sum	3	3	9
N	33	27	36
Assessment of FIP = 2 × Sum/N	0.18	0.22	0.5

Average assessment	**0.3**

Faculty interactions

SL NO.	FACULTY NAME	VENUE	TOPIC OF SESSION	DATE
1	RICHU THOMAS	MOUNT ZION COLEGE OF ENGINEERING	MODERN TRENDS IN AEROSPACE INDUSTRY	16-Mar-13
2	RICHU THOMAS	BENNARI AMMAN INSTITUTE OF TECHNOLOGY AND SCIENCE	COMPUTATIONAL FLUID DYNAMICS	20-SEPT. 2014
3	TOM SUNNY	KISSAN JYOTHI EHIBITION PARATHODU, KALAKETTY	INTERACTION WITH FARMERS	07-Apr-15
4	K P SUNDARESWAREN	LSGD THAMARASSERY	PROJECT EVALUATION	
5	MATHEW J JOSEPH	ST. THOMAS CHURCH VELICHIYANI KANJIRAPALLY	CAREER GUIDANCE	10-Feb-15
6	DR. KURIEN ANTONY	MUSALIAR COLLEGE OF ENGINEERING PATHANAMTHITTA	ADDITIVE MANUFACTURING	17-Apr-15
7	DR.JIPPU JACOB	BISHOP JEROME COLLEGE KOLLAM	INNOVATION	2014
8	DR. JIPPU JACOB	GEC IDUKKI	PATENTING, INNOVATION	06-Aug-15

6. Facilities and Technical Support (125)

Description of classrooms, faculty rooms, seminar, and conference halls:

6.1. *Classrooms in the department (30)*

6.1.1. Adequate number of rooms for lectures (core/electives), seminars, tutorials, etc., for the programme (10)

(Instruction: Assessment based on the information provided in the preceding Table.)

Adequate number of class rooms are available for conducting lectures and tutorials. There are a total of 8 class rooms for conducting U.G classes (1st year, 2nd year, 3rd year and 4th year). The class rooms are equipped with most modern LCD projectors which can be used for Power point presentations and showing vides of interest. Conventional black boards are also provided in every class room. Class rooms are spacious enough to accommodate 60 students and are well furnished and ensures proper circulation of fresh air and light State of the art seminar halls are available which are made use for conducting lectures by eminent persons from industry and academia

Class rooms are equipped with LCD projectors to aid multimedia presentations. Conventional black /green boards are also provided.

The following table shows the details of class rooms available with the department

DETAILS OF CLASS ROOMS					
SL .#	CLASS/LAB	STUDENTS STRENGTH	ROOM NO	AREA IN M^2	DETAILS OF FURNITURE
1	1st Year (B. Tech)	118	R 207 & R 210	99	Wooden Desks & Benches-22 Sets, Teachers Table, Chair, Green chalk Board
3	2nd Year (B. Tech)	124	CC207& CC209	96	Wooden Desks & Benches-22 Sets, Teachers Table, Chair, Green chalk Board
4	3rd Year (B. Tech)	121	CC307 & CC309	96	Wooden Desks & Benches-22 Sets, Teachers Table, Chair, Green chalk Board

5	4th Year (B. Tech)	117	CC 407 & C C409	99	Wooden Desks & Benches-22 Sets, Teachers Table, Chair, Green chalk Board
6	Faculty room -I	11	CC 210	120	Office table , Office chair, Computers, Steel Shelves etc, File rack, Internet, Wi-Fi
7	Faculty Room -II	12	CC 310	120	Office table , Office chair, Computers, Steel Shelves etc, File rack, Internet, Wi-Fi
8	Faculty Room -II	10	CC 410	120	Office table , Office chair, Computers, Steel Shelves etc, File rack, Internet, Wi-Fi
9	HOD Room	1	CC 314	21	Office table, Office chair, Personal Computer, Internet, Wi-Fi Steel Shelf

6.1.2. Teaching aids-multimedia projectors, etc. (15)

(Instruction: List the various teaching aids available)

Sl. No	Teaching Aids	Exclusive/shared
1	Model of an IC engine	Exclusive
2	Model of hexagonal pyramid (for graphics)	Exclusive
3	Model of pentagonal pyramid (for graphics)	Exclusive
4	Model of square pyramid (for graphics)	Exclusive
5	Model of triangular pyramid (for graphics)	Exclusive
6	Model of cylindrical prism (for graphics)	Exclusive
7	Model of triangular prism (for graphics)	Exclusive
8	Model of square prism (for graphics)	Exclusive
9	Model of pentagonal prism (for graphics)	Exclusive
10	Model of hexagonal prism (for graphics)	Exclusive
11	Automobile parts (heat engine lab)	Exclusive
12	Model of intersections (for graphics)	Exclusive
13	Solid model of couplings (machine drawing)	Exclusive

14	ASUS Netbooks	8 nos-Exclusive
15	Model of screw threads	Exclusive
16	Model of nut threads	Exclusive
17	Multimedia projectors	8 nos in each class room + one LCD projector exclusively for department

6.1.3. Acoustics, classroom size, conditions of chairs/benches, air circulation, lighting, exits, ambience, and other such amenities/facilities (5)

(Instruction: Assessment based on the information provided in the preceding table and the inspection thereof.)

All class rooms are fully furnished with tables, benches and desk made of high quality timber. Class rooms are spacious enough to accommodate 60 to 70 students. Class rooms are well lit with windows opening to natural light and air. In addition sufficient number of tubes and fans are provided. Curtains are also provided so as to minimize the effect of extreme sunlight during afternoons.

Since classrooms are provided with good ventilation and are spacious, there is no problem with echo or the acoustics of the rooms is very good.

6.2. Faculty rooms in the department (20)

6.2.1. Availability of individual faculty rooms (5)

(Instruction: Assessment based on the information provided in the preceding table.)

There are individual cabins for Mechanical Engineering faculty in addition to a separate room for H.O.D. The cabins are partitioned such that each faculty gets sufficient working space for himself/herself. Each faculty is provided with a personal computer in the form of desktop computers or net books. Internet connectivity in the form of LAN or Wi-Fi is also provided.

6.2.2. Rooms equipped with white/black board, computer, internet, and other such amenities/facilities (10)

(Instruction: Assessment based on the information provided in the preceding table)

All the faculty rooms are equipped with white board, Computer with internet facility and telephone with intercom facility.

The entire campus is Wi-Fi enabled.

Details of class rooms in the department

Details of class rooms in the department is shown in the table below:

Room description	No	Shared/ exclusive	Seating Capacity	Quality
Classrooms	8	E	66	Well maintained class room with sufficient number of ceiling fans, natural ventilation, natural lighting, sufficient space for movement , LCD projector, sufficient no of seating capacity, good quality writing board, etc.
No. of tutorial rooms	8 (Free Class rooms are used	E	66	Well maintained class room with sufficient number of ceiling fans, natural ventilation, natural lighting, sufficient space for movement , LCD projector, sufficient no of seating capacity, good quality writing board, etc.
No. of meeting rooms (04)	Meetings	Shared	Minimum 100 each	LCD projectors
No. of seminar rooms	4	S	Minimum 100 each	LCD projector, chairs, Sufficient number of fans, natural ventilation and lighting,
Department Library	1	E		Library books for Mechanical Engg. Students & space for reading
Faculty room	2	E	10	Office table, chairs, PC, personal net books, LAN, Wi-Fi etc.
HOD Room	1	E	1	Office table, chairs, PC, Internet, Wi-Fi

6.2.3. Usage of room for discussion/counseling with students (5)

(Instruction: Assessment based on the information provided in the preceding table and the inspection there of.)

Staff rooms are made student friendly. Students are always welcome to approach the faculty both for their academic as well as personal needs. Mentoring sessions are held regularly in the staffrooms where students can approach their respective mentors for guidance/counseling

6.3. Laboratories in the department to meet the Curriculum Requirements and the POs (60)

The following Table is required for the subsequent criteria.

Laboratory description in the curriculum	Exclusive use / shared	Space, number of students	Number of experiments	Quality of instruments	Laboratory manuals
EN 010 105 Engineering Graphics	Exclusive	3 rooms have seating capacity of 60 and remaining 2 have 120	10 sheets	Good	Available
EN 010 110 Mechanical workshop	Exclusive	4 lab rooms having 15/ batch	8	Good	Available
ME010 308 Fluid Mechanics Lab	Exclusive	30/batch	15	Good	Available
ME010 407 Hydraulic Machines Lab	Exclusive	30/batch	16	Good	Available
ME010 507 CAD/CAM Lab	Exclusive	60/batch	14	Good	Available
ME010 607 Heat engines lab	Exclusive	30/batch	9	Good	Available
ME010 608 Machine tools lab	Exclusive	30/batch	10	Good	Available
ME010 707 Mechanical Measurements Lab	Exclusive	30/batch	12	Good	Available
ME010 708 Advanced Machine Tools Lab	Exclusive	30/batch	8	Good	Available
ME010 806 Mechanical Systems Lab	Exclusive	30/batch	15	Good	Available
ME010 807 Project	Exclusive	4/batch	-	Good	Available
ME010 808 Viva Voce	Exclusive	1 at a time			

6.3.1. Adequate, well-equipped laboratories to meet the curriculum requirements and the POs (20)

(Instruction: Assessment based on the information provided in the preceding Table.)

All the labs are well equipped and well maintained. Maintenance and calibration of the instrument is carried out as when necessary. Technical staff is well trained for the maintenance and calibration of the instruments as and when necessary.

The following Table shows the equipment/instruments available in each lab to meet the curriculum requirements and the POs

Sl. No	Name of Labs		List of Equipment's/ Instruments	Quantity
1	Mechanical workshop	Smithy	Anvil 25kg	1
			Anvil 50kg	7
			Anvil 75 kg	1
			Bench Vice	1
			Swage Block	1
			Electric Blower	1
			Cold Chisel	2
			Cold Chisel	5
			Number Punch	3set
			Outside Caliper	6
			Inside Caliper	6
			Divider	2
			GI Bucket	1
			Patchwork hammer2	
			Cross peen hammer1lb	3
			Ballpeen hammer1/4lb2	2
			Ballpeen hammer1.5lb	8
			Sledge hammer4lbs	5
			Sledge hammer5lbs	4
			Sledge hammer12lbs	2
			Steel rule 300mm	10
			Steel rule 150mm	2
			Centre punch	2
			Hacksaw frame	7
			Flatfilebastard250mm	2
			Round tongs18"	3
			Flat tongs 18"	25
			Round hollow tongs	10
			Try square	6
			Leather gloves	pair 4
			Charcoal carrier	1
			Poker	3
			Plier	1
			ScrewDriver10"	1
			Sledge hammer4lbs	5
		Fitting	V block	2
			Thread gauge	1
			Surface gauge	2
			Scriber block	12
			Centre punch	10
			Dot punch	2

			Letter punch	1
			Number punch	1
			Hacksaw	12
			Flat files (all dimensions)	57
			Half round cut	6
			Vernier and outside caliper	5
			Round chisel	6
			Square file 200mm	6
			Flat chisel	10
			Combination cutter plier	1
			Twist drill set	1
			Tap set M 8 x 1.25	1
			Tap set M 6 x 1.00	1
			Tap set M 10 x 1.5	1
			Split die M 8 x 1.25	1
			Split die M 10 x 1.5	1
			Split die M 06 x 1	1
			Die stock dia 40mm	1
			Diamond point wheel dresser	1
			Ball peen hammers (1.5lbs,1lb, 0.5lb)	18
			Cross peen hammer	3
			Mallet	1
			Allen key 1 set	1
			Vice	14
			Grinder	1
			Off set wrench	12
			Double end spanner set	24
		Foundry	Molding flask	24 set
			Molding board	24
			Shovel	14
			Floor Rammer	25
			Hand Rammer	27
			Riddle	1
			Patterns- Step and core type	20 & 30
			Strike off bar- wooden and aluminum	4 & 12
			Trowels- Finishing and square	20 & 16
			Slick	18
			Mallet wooden	6
			Lifter	11
			Gate cutter	16
			Runner, riser	24
			Vent rod	26
			Draw spike	28
			Bellows	1
		Carpentry	Plane	15
			Saw	10
			Vice	15
			Chisel	50
			File	20
			Steel rule	15
			G Clamp	6
2	Fluid mechanics lab		Venturimeter	1

		Orficemeter	1
		Rectangular and triangular notch	1
		Orifice	1
		Metacentre	1
		Bernoulli's apparatus	1
		Major loss and minor loss apparatus	1 each
3	Hydraulics machine lab	Pelton turbine	1
		Kaplan turbine	1
		Francis turbine	1
		Centrifugal pump	1
		Jet pump	1
		Gear pump	1
		Self-priming pump	1
		Multi centrifugal pump	1
		Reciprocating pump	1
		Hydraulic ram	1
4	CAD/CAM lab	Computers(with all software's)	45
5	Thermal & Heat engines lab	Heat transfer equipment's	9
		Engines	7
		Blower	1
		Compressor	1
6	Machine tools and advanced machine tools lab	Lathe	19
		Shaper	9
		Surface grinder	1
		Milling machine	2
		Slotting machine	1
		Radial drilling machine	1
		Sensitive drilling machine	1
		Hand drill	1
		Bench grinder	1
		Welding set	2
		Power saw	1
		Hand grinder	1
		Milling machine vice	2
		Rotary table	2
		Vertical attachment	2
		Dividing head	2
		Chuck with back plate	2
		Rack cutting attachment	1
		Reduction sleeve(iso40xmt2)	2
		Collet holder(2 set)	2
		Vernier caliper 6"	12
		Micrometer (0-50mm)	12
		Vernier dial gauge 200mm	1
		Sine bar	2
		Snap gauge double ended 75mm	1
		Plain plug gauge 20mm	1
		Clinometer (0 to360 degree)	1
		Universal bevel protractor	1
		Slip gauge- 87pieces	1set

		Surface gauge fixed 12"	12
		Universal surface gauge	1
		Trysquare 8"	2
		Depth gauge 6"	1
		Thread gauge	2
		Thread gauge (pitch gauge)	1
		Vernier height gauge 300mm	1
7	Mechanical measurements lab	Trainers	8
		Tester apparatus	1
		Vibration measurement apparatus	3
		Speed measurement apparatus	1
		Roughness tester	1
		Tool makers microscope	1
		Profile projector	1
8	Mechanical systems lab	Universal vibration apparatus	1
		Governors	4
		Gyroscope	1
		Whirling shaft	1

6.3.2. Availability of computing facilities in the department (15)

(Instruction: Assessment based on the information provided in the preceding table.)

A computer lab with sufficient number of computers with high speed internet connectivity is available for students' use. Licensed software such as AUTO CAD, PRIMAVERA, ABAQUS, ANSYS etc. are provided.

Computer Lab	Computers	70
	Prima Vera P6 Soft ware	Five user
	ABAQUS Soft ware	Five user
	Auto CAD Soft ware	Five user
	ANSYS Soft ware	Five user

6.3.3. Availability of laboratories with technical support within and beyond working hours (15)

(Instruction: Assessment based on the information provided in the preceding table.)

All labs are assisted by competent technical staff with thorough knowledge of various experiments and procedures. Students are encouraged to make maximum use of labs for conducting their project works during and beyond class hours.

The following Table shows the duties allotted for the technical staff to help the students for doing experiments beyond working hours. Technical support will be available for students from 8 am to 8 pm according to the requirement of the students

Name of Technical staff	Designation	Qualification	Other technical skills gained after joining AJCE	Responsibility
Thomas Joseph	Senior workshop instructor	DME	Capable of doing all experiments in the lab	Foundry workshop in charge
Vinu K Varghese	Workshop instructor Grade-1	ITI	Capable of doing all experiments in the lab	Carpentry workshop in Charge
Jiby Zacharias	Lab instructor	DME	Capable of doing all experiments in the lab	Hydraulics lab in charge
Ranjith V.K	Lab instructor Grade-1	DME	Capable of doing all experiments in the lab	Thermal Lab in charge
Balachandran	Lab instructor Grade 2	ITI	Capable of doing all experiments in the lab	Advanced Machine tool lab in charge
Jose Mathew	Workshop instructor	NCTVT	Capable of doing all experiments in the lab	Fitting Workshop in charge

Anvin M. Mathew	Lab instructor grade 2	DME	Capable of doing all experiments in the lab	Measurements lab in charge
T. A Abraham	Senior lab Assistant	ITI machinist	Capable of doing all experiments in the lab	Machine tool lab in charge
Dijo T Abraham	Lab Instructor	ITI, Mechanical refrigeration & Air conditioning	Capable of doing all experiments in the lab	Fluid mechanics lab in charge

6.3.4. Equipment to run experiments and their maintenance, number of students per experimental setup, size of the laboratories, overall ambience, etc. (10)

(Instruction: Assessment based on the information provided in the preceding table.)

All labs are well lit and have continuous power supply which ensures unhindered working of machines. Around 5-6 students work on a single experimental setup at a time

The following Table gives the details of experiment set up available in each Mechanical Engineering Laboratory

Name of Lab:	**Fluid mechanics lab**				
Sl. No	Name of Experiment	Equipment/Instrument used	No.of Expt set up	No of Students per Expt set up	Remarks
1	Metacentric height and radius of gyration of floating body	Metacentre	1	5	Good quality
2	Determination of Darcy's and Chezy's constant for pipe flow	Pipe friction apparatus	1	5	Good quality
3	Determination of minor losses	Minor loss apparatus	1	5	Good quality
4	Determination of coefficient of discharge of Venturimeter	Venturimeter	1	5	Good quality

5	Determination of coefficient of discharge of Orficemeter	Orficemeter	1	5	Good quality
6	Determination of coefficient of discharge of mouthpiece by varying head method	Mouthpiece	1	5	Good quality
7	Bernoulli's apparatus	Bernoulli's apparatus	1	5	Good quality
8	Determination of coefficient of discharge of orifice plate by varying head method	Orifice plate	1	5	Good quality
9	Constant head method for determination of cd, cv & cc of orifice plate	Orifice plate	1	5	Good quality
10	Constant head method for determination of cd, cv & cc of mouthpiece	Mouthpiece	1	5	Good quality
11	Determination of coefficient of discharge of triangular notch	Triangular notch	1	5	Good quality
12	Determination of coefficient of discharge of Rectangular notch	Rectangular notch	1	5	Good quality

Name of Lab : Hydraulics machine lab

Sl.No	Name of Experiment	Equipment/Instrument used	No.of Expt set up	No of Students per Expt set up	Remarks
1	Load test on pelton wheel turbine	Pelton turbine	1	5	Good Quality
2	Best speed test on Pelton turbine	Pelton turbine	1	5	Good Quality
3	Load test on Kaplan turbine	Kaplan turbine	1	5	Good Quality
4	Vane opening test on Kaplan turbine	Kaplan turbine	1	5	Good Quality
5	Load test on Francis turbine	Francis turbine	1	5	Good Quality
6	Vane opening test on Francis turbine	Francis turbine	1	5	Good Quality

7	Performance test on reciprocating pump	Reciprocating pump	1	5	Good Quality
8	Performance test on self-priming pump	Self-priming pump	1	5	Good Quality
9	Performance test on centrifugal pump	centrifugal pump	1	5	Good Quality
10	Performance test on jet pump	Jet pump	1	5	Good Quality
11	Iso efficiency test on centrifugal pump	Centrifugal pump	1	5	Good Quality
12	Performance test on gear oil pump	Gear oil pump	1	5	Good Quality
13	Comparison of efficiencies with parallel and series centrifugal pumps.	Centrifugal pumps	1	5	Good Quality
14	Prove Pascal's law	Hydraulic ram	1	5	Good Quality

Name of Lab : Machine tools lab

Sl. No	Name of Experiment	Equipment/Instrument used	No. of Expt set up	No of Students per Expt set up	Remarks
1	Facing operation	Lathe	17	2	Good Quality
2	Centering and plane turning	Lathe	17	2	Good Quality
3	Stepped turning	Lathe	17	2	Good Quality
4	Grooving	Lathe	17	2	Good Quality
5	Taper turning	Lathe	17	2	Good Quality
6	Form turning	Lathe	17	2	Good Quality
7	Thread cutting	Lathe	17	2	Good Quality
8	Knurling	Lathe	17	2	Good Quality

9	Undercutting	Lathe	17	2	Good Quality
10	Internal thread cutting	Lathe	17	2	Good Quality
11	Drilling and boring (counter boring)	Lathe	17	2	Good Quality
12	Welding	Arc welding apparatus	1	2	Good Quality

Name of Lab : Advanced machine tools lab

Sl. No	Name of Experiment	Equipment/Instrument used	No. of Expt set up	No of Students per Expt set up	Remarks
1	Plain shaping	Shaper	7	2	Good Quality
2	Square grooving	Shaper	7	2	Good Quality
3	V-Grooving	Shaper	7	2	Good Quality
4	Plain milling	Milling machine	1	2	Good Quality
5	Step milling	Milling machine	1	2	Good Quality
6	Gear cutting	Milling machine	1	2	Good Quality
7	Internal keyway cutting (4 numbers)	Slotting machine	1	2	Good Quality
8	Drilling	Drilling machine	3	2	Good Quality
9	Tapping	Drilling machine	3	2	Good Quality
10	Surface grinding	Surface grinder	1	2	Good Quality

11	Metal cutting for experiments	Power saw	1	2	Good Quality

Name of Lab : Mechanical measurements lab					
Sl. No	Name of Experiment	Equipment/Instrument used	No. of Expt set up	No of Students per Expt set up	Remarks
1	Experiment on dead weight pressure gauge tester	Tester	1	5	Good Quality
2	Experiment on strain measurement trainer (cantilever beam)	Trainer	1	5	Good Quality
3	Experiment on vibration measurement trainer	Trainer	1	5	Good Quality
4	Experiment on pressure measurement trainer	Trainer	1	5	Good Quality
5	Experiment on proving ring with load cell and dial gauge	Trainer	1	5	Good Quality
6	Experiment on Auto-Collimator for surface straightness measurement	Auto-Collimator	1	5	Good Quality
7	Experiment on temperature measurement trainer	Trainer	1	5	Good Quality

8	Experiment on speed measurement trainer	Trainer	1	5	Good Quality
9	Experiment on tool makers microscope	tool makers microscope	1	5	Good Quality
10	Experiment on profile projector	profile projector	1	5	Good Quality
11	Experiment on transverse vibration apparatus	trainer	1	5	Good Quality
12	Experiment on Psychrometer for WBT & DBT	Psychrometer	1	5	Good Quality
13	Experiment on Vernier caliper and micrometer	Vernier caliper and micrometer	4 each	4	Good Quality
14	Experiment on load measurement trainer	Trainer	1	5	Good Quality

Name of Lab: Thermal and heat engines lab

Sl. No	Name of Experiment	Equipment/Instrument used	No. of Expt set up	No of Students per Expt set up	Remarks
1	Load test on single cylinder diesel engine	single cylinder diesel engine	1	5	Good Quality

2	Load test on twin cylinder diesel engine	twin cylinder diesel engine	1	5	Good Quality
3	Load test on single cylinder petrol engine	single cylinder petrol engine	1	5	Good Quality
4	Morse test on four cylinder petrol engine	four cylinder petrol engine	1	5	Good Quality
5	Best cooling temperature on diesel engine	single cylinder diesel engine	1	5	Good Quality
6	Heat balance sheet of twin cylinder diesel engine	twin cylinder diesel engine	1	5	Good Quality
7	Valve timing diagram	Cut section of an engine	1	5	Good Quality
8	Retardation test on diesel engine	Anil engine (diesel)	1	5	Good Quality
9	Volumetric efficiency test on single cylinder diesel engine	single cylinder diesel engine	1	5	Good Quality
10	Tests on refrigeration equipment to determine the COP	Refrigeration equipment	1	5	Good Quality
11	Tests on Air conditioning equipment to determine the COP	Air conditioning	1	5	Good Quality

12	Determination of thermal conductivity of conducting and insulating materials	Thermal conductivity testing apparatus	1	5	Good Quality
13	Determination of emissivity of surfaces	Emissivity testing apparatus	1	5	Good Quality
14	Heat flow through lagged pipes	Lagged pipe apparatus	1	5	Good Quality
15	Heat flow through composite walls	Composite walls apparatus	1	5	Good Quality
16	Determination of overall heat transfer coefficient of a heat exchanger	Parallel and cross flow heat exchanger	1	5	Good Quality
17	Determination of heat transfer coefficient in free convection	Free convection apparatus	1	5	Good Quality
18	Experiment on forced convection	Forced convection Apparatus	1	5	Good Quality

Name of Lab: Mechanical systems lab

Sl. No	Name of Experiment	Equipment/Instrument used	No. of Expt set up	No of Students per Expt set up	Remarks
1	Experiment on universal vibration apparatus	Torsional vibrational apparatus Longitudinal vibration of spring mass system	1	5	Good quality instruments

2	Experiment on governor apparatus	Porter governor	1	5	Good quality instruments
		Proell governor	1		
		Hartnell governor	1		
		Watt governor	1		
3	Experiment on static and dynamic balancing	Static and dynamic apparatus	1	5	Good quality instruments
4	Experiment on determining critical speed	whirling of shaft apparatus	1	5	Good quality instruments
5	Experiment on gyroscopic effect	Gyroscope	1	5	Good quality instruments

Following table shows the details of laboratories in the department

SL .#	CLASS/LAB	STUDENTS STRENGTH	ROOM NO	AREA IN M^2	Over all ambience
1	Carpentry	20	WS 01	$47m^2$	Well maintained equipment, neat and tidy, spacious & well ventilated room
	Foundary	20	WS 02	$44m^2$	
	Fitting	20	WS 03	$143m^2$	
	Smithy	20	WS 05	$143m^2$	
2	Fluid mechanics lab	30	CCB 204	$165m^2$	Well maintained equipment, neat and tidy, spacious & well ventilated room,
3	Hydraulics Lab	30	CCB 204	$220m^2$	Well maintained equipment, neat and tidy, spacious & well ventilated room,
4	Machine tools lab	30	CCB206	$630m^2$	Well maintained equipment, neat and tidy, spacious & well ventilated room
5	Measurements lab	30	CC108	$165m^2$	Well maintained equipment, neat and tidy, spacious & well ventilated room,

6	Mechanical Systems lab	30	CC105	161m^2	Well maintained equipment, neat and tidy, spacious & well ventilated room,
7	Heat engines and thermal lab	30	ME L01 ME L02	360m^2	Well maintained equipment's, neat and tidy, spacious & well ventilated room,
8	CAD/CAM lab	45	CCB 104	85m^2	Well maintained equipment's, neat and tidy, spacious & well ventilated room,

6.4. Technical Manpower Support in the Department (15)

Name of the technical staff	Designation	Pay-scale	Exclusive / shared work	Date of joining	Qualification		Other technical skills gained	Responsibility
					At Joining	Now		
Thomas Joseph	Senior workshop instructor		Exclusive	22/10/2001	DME	DME	Capable of doing all experiments in the lab	Foundry workshop in charge
Vinu K Varghese	Workshop instructor Grade-1		Exclusive	03/01/2003	ITI	ITI	Capable of doing all experiments in the lab	Carpentry workshop in Charge
Jiby Zacharias	Lab instructor		Exclusive		DME	DME	Capable of doing all experiments in the lab	Hydraulics lab in charge
Ranjith V.K	Lab instructor Grade-1		Exclusive	02/08/2005	DME	DME	Capable of doing all experiments in the lab	Thermal Lab in charge
Balachandran	Lab instructor Grade 2		Exclusive	10/08/2006	ITI	ITI	Capable of doing all experiments in the lab	Advanced Machine tool lab in charge
Jose Mathew	Workshop instructor		Exclusive	12/02/07	NCTVT	NCTVT	Capable of doing all experiments in the lab	Fitting Workshop in charge
Anvin M. Mathew	Lab instructor grade 2		Exclusive	19/07/2010	DME	DME	Capable of doing all experiments in the lab	Measurements lab in charge
T.A Abrham	Senior lab assistant		Exclusive	01/07/2009	ITI, machinist	ITI, machinist	Capable of doing all experiments in the lab	Machine tool lab in charge
Dijo T Abraham	Lab Instructor		Exclusive		DME	DME	Capable of doing all experiments in the lab	Fluid mechanics lab in charge

6.4.1. Availability of adequate and qualified technical supporting staff for programme- specific laboratories (10)

Qualified technical staff is available for all the labs as evidenced from the above Table (Item 6.4)

(Instruction: Assessment based on the information provided in the preceding table.)

6.4.2. **Incentives, Skill upgrade, and Professional advancement (5)**

All the technical supporting staffs are encouraged to attend skill enhancement training programs arranged by the Department or other institutes/industries

List of programs attended by technical staffs

- Fitting & carpentry workshop.
- Turning operation training for first years.
- One week Auto CAD training for technical staffs.
- Yearly induction and orientations programs conducted by college for all technical staffs.

7. Academic Support Units and Teaching-Learning Process (75)

Students' Admission

Admission intake (for information only)

Item	CAY	CAY*m*1	CAY*m*2	CAY*m*3
Sanctioned intake strength in the institute (*N*)	780	780	720	600
Number of students admitted on merit basis (*N*1)	594	562	540	512
Number of students admitted on management quota/otherwise (*N*2)	122	122	100	3
Total number of students admitted in the institute (*N*1+*N*2)	716	684	640	515

(Instruction: The intake of students during the last three years against the sanctioned capacity may be reported here.)

Admission quality (for information only)

(Instruction: The admission quality of the students in terms of their ranks in the entrance examination may be presented here.)

Divide the total admitted ranks (or percentage marks) into five or a few more meaningful ranges

Rank range	CAY	CAYm1	CAYm2	CAYm3
More than 80 percentile	1	3	1	2
50--80 percentile	6	3	9	3
30--50 percentile	30	11	61	5
20--30 percentile	69	44	112	4
10--20 percentile	215	200	231	45
0--10 percentile	273	302	126	453
Admitted outside rank list	122	122	100	3

Tabular data for estimating student-teacher ratio and faculty qualification for first year common course

List of faculty members teaching first year courses:

Name of faculty member	Qualifi-cation	Desig-nation	Date of joining institution	Depart-ment with which associated	Distribution of teaching load (%)		
					1st year	UG	PG
Abin Manoj	Ph. D	Assoc. Prof.	26/01/2005	DBS	100	0	0
Shinto Sebastian	M. Tech.	Asst. Prof.	01-11-2010	ECE	60	40	0
Aju S Nair	M. Tech.	Asst. Prof.	06-02-2014	EEE	25	20	65
Nobin Thomas	M. Sc., M Phil	Asst. Prof.	07-01-2013	DBS	62	38	0
Neenu K Mathew	M. Tech.	Asst. Prof.	06-03-2014	CE	35	65	0
Linu Tess Antony	M.Sc. B. Ed	Asst. Prof.	07-02-2008	DBS	31	69	0
Joy Cyriac	M.Sc.	Professor	10-01-2004	DBS	100	0	0
Thomaskutty Stephen	M.Sc.	Asst. Prof.	01-11-2010	DBS	31	53	16
Jibin C Jacob	M. Tech.	Asst. Prof.	28/01/2008	ME	31	69	0
Ashwin Chandy Alex	M. Tech.	Asst. Prof.	07-09-2013	ME	33	67	0
Abu Mani	M. Tech.	Asst. Prof.	07-01-2013	ME	33	67	0
Mathew K.J.	M. Tech.	Asst. Prof.	29/12/2010	AUE	33	76	0
Jacob Philip	Ph. D	Professor	14/07/2014	DBS	100	0	0
Reeju Elisa Baby	M. Tech.	Asst. Prof.	28/06/2011	ECE	50	50	0
Manu Harilal	M. Tech.	Asst. Prof.	18/06/2014	MT	25	75	0
Sini Rose Devasia	M Sc., M Phil, B. Ed	Asst. Prof.	07-02-2012	DBS	30	54	16
Sharon Jacob	M. Tech.	Asst. Prof.	08-01-2014	CE	45	55	0
Francis. K	M. Tech.	Asst. Prof.	07-01-2013	ME	25	37	38
Deepthi I Gopinath	M. Tech.	Asst. Prof.	24/07/2014	CE	49	51	0
Priya Philip	M. Tech.	Asst. Prof.	24/07/2014	CE	49	51	0
Deepak John Peter	M. Tech.	Asst. Prof.	22/07/2013	CE	31	69	0
Jose Joseph	M. Tech.	Asst. Prof.	07-04-2013	CE	27	73	0
George Mohan	M. Tech.	Asst. Prof.	07-04-2013	CE	31	69	0
Minnu M	M. Tech.	Asst. Prof.	16/07/2014	CE	49	51	0
Jeena B Edayadiyil	M. Tech.	Asst. Prof.	20/08/2013	CE	42	58	0
Linu Theresa Jose	M. Tech.	Asst. Prof.	07-01-2013	CE	31	38	31
Maria Michael	M. Tech.	Asst. Prof.	08-01-2014	CE	33	40	27
Vipin Vijayan	M. Tech.	Asst. Prof.	08-01-2014	ME	62	38	0
Rony Thomas Murickan	M. Tech.	Asst. Prof.	15/07/2013	ME	31	69	0
George M Varghese	M. Tech.	Asst. Prof.	07-01-2014	CE	10	53	37
Tessy Annie Varghese	M. Tech.	Asst. Prof.	07-01-2011	ECE	23	77	0
Subin P George	M S	Asst. Prof.	12-09-2013	ECE	20	0	80
Richu Zachariah	M. Tech.	Asst. Prof.	07-01-2014	ME	63	10	27
Merene Joseph	M. Tech.	Asst. Prof.	07-01-2013	ECE	22	78	0
Mathew George	M. Tech.	Asst. Prof.	07-01-2013	ECE	38	62	0
Midhu Das B.	M. Tech	Asst. Prof.	16/06/2014	EEE	31	56	13
Jinson Paul	M.E	Asst. Prof.	07-02-2014	AUE	29	69	0
Shany Jophin	M. Tech.	Asst. Prof.	07-07-2014	CSE	25	65	10
Rino Laly Jose	M. Sc.,	Asst. Prof.	22/08/2012	DBS	57	43	0

	B.Ed., NET						
Margret Sherin Joseph	M. Tech.	Asst. Prof.	07-02-2012	CE	32	68	0
Anjana P.	M. Tech.	Asst. Prof.	01-01-2015	CE	44	0	0
Nimmy Chacko	M. Sc.	Asst. Prof.	07-04-2011	DBS	29	55	16
Jose J Edathala	M. Tech.	Asst. Prof.	16/08/2007	ECE	25	62	13
Anitta Jose	M. Tech.	Asst. Prof.	07-07-2015	CE	49	51	0
Dona Sebastian	M. Tech.	Asst. Prof.	07-01-2013	EEE	40	60	0
Ajosh Abraham	M. Tech.	Asst. Prof.	28/12/2009	ME	22	78	0
Deepamole S	M Sc., M Phil. B. Ed	Asst. Prof.	20/07/2009	DBS	32	63	5
Rakesh Reghunath	M Tech	Asst. Prof.	15/12/2008	ME	12	50	38
Reynold Jose	M. Tech	Asst. Prof.	16/08/2007	AUE	9	91	0
Binu Thomas	M. Tech.	Asst. Prof.	07-04-2005	ME	62	38	0
Toms Philip	M. Tech.	Asst. Prof.	28/08/2006	ME	68	0	32
Amal Sajikumar	M. Tech.	Asst. Prof.	01-01-2015	ME	18	82	0
Bini Koshy Varghese	M. Tech.	Asst. Prof.	08-01-2013	ME	18	47	35
Yelana Thomas	M.A., B. Ed	Asst. Prof.	14-8-2008	HUM	6	81	6
Meby Mathew	M E	Asst. Prof.	07-08-2013	ME	40	44	16
Sebastian Narively	MA Ph. D	HOD	26-11-2006	HUM	100	0	0
M N Muraleedharan	B. Sc. Engg.	Asst. Prof.	31/12/2007	AUE	70	30	0
Mathew J Joseph	M. Tech.	Asst. Prof.	07-02-2012	ME	62	38	0
Lisa Rani Alex	M. Sc., M. Phil B. Ed	Asst. Prof.	07-04-2007	DBS	54	9	37
V. I. Cherian	M. E.	Professor	1.8.2006	EEE	29	0	71
Neenu Rose Antony	M. Tech.	Asst. Prof.	22/6/2009	EEE	27	73	0
Shamini James	MBA	Asst. Prof.	07-04-2011	HUM	7	61	32
Jasmine Mathew	M Sc.	Asst. Prof.	07-06-2010	DBS	32	68	0
K P Sundareswaran	M Tech	Professor	10-01-2002	ME	17	83	0
Jency Sara Kurian	M Tech	Asst. Prof.	12-01-2014	CE	27	73	0
Joffie Jacob	M Tech	Asst. Prof.	15/12/2008	EEE	28	28	44
Sajith Kurian	Ph. D	Assoc. Prof.	15/07/14	DBS	100	0	0
Anumod D M	M Tech	Asst. Prof.	07-03-2014	EEE	14	79	14
Rose Jacob	M. Sc., M. Phil	Asst. Prof.	08-08-2012	DBS	100	0	0
Jose Dominic Joseph	MTM, B. Sc., B. Ed	Asst. Prof.	07-04-2013	HUM	6	81	13
Sherin Thampi	ME	Asst. Prof.	07-01-2014	ME	50	50	0
Tom Sunny	M. Tech	Asst. Prof.	15/1/2014	ME	50	50	0
Sangeeta S	M.A, B.Ed., SET	Asst. Prof.	07-04-2013	HUM	6	91	3
Rohitha Joseph	M. Tech.	Asst. Prof.	07-01-2014	CE	54	46	0
Saju Sebastian	ME	Asst. Prof.	01-01-2015	ME	31	69	0
Vishnu Prasad	M. Tech.	Asst. Prof.	07-02-2014	AUE	50	50	0

7.1 Academic Support Units (35)

7.1.1 Assessment of First Year Student Teacher Ratio (FYSTR) (10)

Data for first year courses to calculate the FYSTR:

Year	Number of students (approved intake strength)	Number of faculty members considering fractional load)	FYSTR	Assessment = (10×15) /FYSTR (Max.is10)
CAY*m*2	690	27.45	25.14	5.97
CAY*m*1	780	30.78	25.34	5.92
CAY	780	30.27	25.77	5.82
Av	**5.90**			

7.1.2. Assessment of Faculty Qualification Teaching First Year Common Courses (15)

Assessment of qualification $= 3 \times (5x + 3y + 2z_0)/N$, where $x + y + z_0 \leq N$ and $z_0 \leq Z$

x = Number of faculty members with Ph. D

y = Number of faculty members with ME/M. Tech./NET-Qualified/MPhil

z = Number of faculty members with BE/B. Tech. /M. Sc./MCA/MA

N = Number of faculty members needed for FYSTR of 25

Year	*X*	*y*	*z*	*N*	Assessment of faculty
CAY*m*2	3	34	24	27.6	9.65
CAY*m*1	4	48	18	31.2	9.77
CAY	4	64	9	31.2	9.77
Average assessment of faculty qualification					**9.73**

7.1.3 Basic science/engineering laboratories (adequacy of space, number of students per batch, quality and availability of measuring instruments, laboratory manuals, list of experiments) (8)

(Instruction: The institution needs to mention the details for the basic science/engineering laboratories for the first year courses. The descriptors as listed here are only suggestive in nature, not exhaustive.

Laboratory Description	Space Sq. mtr	No. of Students	Software used	Type of Experiments	Quality of Experiments	laboratory Manual
Foundry	44	20	Nil	Preparation of sand mould	Medium	Available
Smithy	143	20	Nil	Making square and hexagonal prisms.	Medium	Available
Carpentry	47	20	Nil	Plaining, Cross halved joined	Medium	Available
Fitting	143	20	Nil	Filing, making rectangle, making step joint.	Medium	Available.
Surveying	73.5	22	Nil	Chain surveying, Compass surveying, Levelling, Study of instruments like theodolite, plane table, total station and other minor instruments.	Medium	Available
Plumbing	73.5	22	Nil	Threading, Jointing, Sanitary fittings, Pipe fittings	Medium	Available
Masonry	30	45	Nil	English bond, Flemish Bond, Arch setting	Medium	Available
Electrical Workshop	114	45	Nil	1. Wiring of 1 lamp controlled by a switch 2. Wiring of two lamps and a 3-pin plug socket controlled by 3 switches 3. Stair case wiring 4. Hospital wiring 5. Godown wiring 6. Tunnel wiring 7. Wiring of distribution board using MCB & ELCB 8. Study of measuring earth resistance and insulation resistance using megger 9. Wiring of fluorescent tube 10. Soldering practice 11. Study of compact fluorescent lamp 12.Home wiring training system, 13.Electrical safety training system	High	Available

7.1.4 Language laboratory (2)

(Instruction: The institution may provide the details of the language laboratory. The descriptors listed here are suggestive in nature, not exhaustive.

Language laboratory	Space, number of students	Software used	Type of experiments	Quality of instruments	Guidance
	A maximum of 66 students can be accommodated.	Orel Software	Students are trained on their Reading, Listening, Speaking and Writing skills	Good	Two faculty members are involved in helping students use the lab .Apart from the guidance given in the subject there are two lab instructors to take care of the technical aspect of the lab.

7.2. Teaching – Learning Process (40)

7.2.1. **Tutorial classes to address student questions: size of tutorial classes, hours per subject given in timetable (5)**

(Instruction: The institution may report the details of the tutorial classes that are being conducted on various subjects and state the impact of such tutorial classes here.)

Provision of tutorial classes in timetable: YES

Tutorial sheets provided: YES
Tutorial classes taken by Faculty

Others. M. Tech Students
No. of tutorial classes per subject per week: ONE

Number of students per tutorial class: 20 to 30

Number of subjects with tutorials: 1st year.....9.....; 2nd year...6......; 3rd year.....6......; 4th year....5........
These tutorials help students secure better marks in the examinations, internal as well as university examinations. Moreover tutorials help the students to gain confidence in their studies

7.2.2. Mentoring system to help at individual levels (5)

(Instruction: The institution may report the details of the mentoring system that has been developed for the students for various purposes and also state the efficacy of such system here

Mentoring is provided for total development of the students. Mentoring is provided after analyzing the problems, if any, faced by each student. Mentoring helps students to get over their difficulties with their studies (course work as well as laboratories). All students are periodically counselled by three full-time counsellors. Career guidance is also given to the students.

Number of Faculty mentors: 152

Number of students per mentor: 20 or less

Frequency of meeting: Minimum twice in a Semester

Each student has to fill up and maintain a Student diary with details of parents/guardian, addresses, contact numbers and an academic history of student marks in all public examinations and class tests in the Engineering courses. Any personal difficulties of the student will also be discussed and the student will be directed to professional counselors, if required. The parents shall always be informed regarding the progress as well as problems, if any, of the students. Mentor shall also keep a track of the academic journal prepared by the student detailing what he/she has learnt in every period. Students' participation in arts and sports items and his personality and character will also be graded by the mentor which can be viewed by the HOD and Principal. Corrective advice is given, if necessary.

Three full time counsellors are available in the college. The students are at liberty to approach any of them for help and guidance.

It is found that the mentoring system in the College is very effective for the development of the students.

7.2.3. Feedback analysis and reward/corrective measures taken, if any (5)

Feedback collected for all courses: YES

Specify the feedback collection process: The students of each class are guided to the Central Computing Facility as per a pre- planned schedule. The students are given 14 questions concerning the faculty who are dealing with theory papers and 9 questions for faculty and staff dealing with Laboratories or workshops. The questionnaire is designed to enable them to give their opinion as Excellent, Very Good, Satisfactory or Poor. Using a computer program the score of each faculty is computed and shall be forwarded to the Principal. The students are also allowed to write whatever comments they want to make about the teachers which will be finally checked by Principal and HOD and forwarded to the faculty concerned.

Percentage of students who participated: More than 90 percent.

Specify the feedback analysis process: The feedback collected from students are first analyzed at the level of HOD and then at the level of faculty appraisal committee, headed by the Principal. The contents of the feedback will be shared with each faculty member individually. The feedback system works as an eye opener for the faculty.

Basis of reward/corrective measures, if any: Best faculty award is given based on students feedback, HOD's evaluation, the faculty's self-appraisal report and the marks given by Faculty appraisal committee, headed by Principal. The increments and promotions are also bear some effect on these scores. Those with very poor marks and with bad comments from many students will be asked to show- cause why they should be allowed to continue in this College.

Number of corrective actions taken in the last three years: 3 faculty members were warned during last three years. The warning led to improvements in their performance and quality of teaching.

(Instruction: The institution needs to design an effective feedback questionnaire. It needs to justify that the feedback mechanism developed by the institution really helps to evaluate teaching, and finally, contributes to the quality of teaching).

7.2.4 Scope for self-learning(5)

(Instruction: The institution needs to specify the scope for self-learning /learning beyond syllabus and creation of facilities for self-learning/learning beyond syllabus.)

In tune with AJCE's vision of being a transformational leader in education, conscious efforts are taken in the academic and allied activities of the college to nurture critical thinking, self-learning, creativity and scientific temper among students.

The college believes that self-learning and learning beyond syllabus have a great scope in the development of the career of an engineer. Everything in engineering cannot be taught in the class room or laboratories. The explosion in knowledge related to applied science and engineering during the last century has been so much that four years is too short a period even to cover one branch of engineering. This fact calls for the relevance for self-learning for young engineers. What an institution should do is to provide adequate facilities for self-learning to students so that they get motivated to learn more and more and ultimately become life-long learners and innovators.

Motivation for self-learning should be provided in the classrooms. A teacher has a great role to play in this. Discussing subject beyond the syllabus, providing exposure to exciting developments in science and technology around the globe, attempting solutions to problems in daily life etc. are the ways to motivate students for self-learning. They should also be motivated to do things themselves so that they gain confidence to try anything with their own hands. An intuition should provide ample opportunities and facilities for these to students. Amal Jyothi College of Engineering has been doing just this, as outlined below.

7.2.5. Generation of self-learning facilities, and availability of materials for learning beyond syllabus (5)

(Instruction: The institution needs to specify the facilities for self-learning/learning beyond syllabus.)

Amal Jyothi College of Engineering (AJCE) has provided the following facilities to students for their self-learning and learning beyond syllabus

Infrastructure

1. 24/7 internet access with Wi-Fi connectivity
2. Smart classrooms with audiovisual aids
3. AES Software, Language lab, Computer Labs etc.

Learning resources:

1. Committed faculty who motivate students in the process of their learning
2. Reputed Journals from IEEE, ACM, Springer, Wiley etc.
3. Online Databases and Digital Video
4. Licensed Soft wares

The institution supports teachers to make learning efficient. The college provides a central library with all latest books and journals which the faculty can utilize effectively and provide comprehensive latest information to students. Students are encouraged to use the library independently to enhance their skills and knowledge. Apart from this college provides seminar halls where the students can participate in group discussions, debates, seminars etc. The institution and faculty members support and encourage every student to make use of Internet, computers and latest technologies available to upgrade themselves in their respective field of studies.

Student projects

Every student in AJCE does three projects during their course. Each student is assigned a Micro project during third semester, a Mini project during fifth semester and a Main project during seventh and eighth semesters. The students have the freedom to select projects of their choice in consultation with teachers. Execution of these projects by themselves goes a long way in developing independent thinking, organizing various elements of work in the project and finding solutions to problems they face. These projects inculcate creativity and innovative mind among students. AJCE thinks that execution of these projects will help to transform students in to life-long learners and innovators.

Promotion of research among Students

The institution has taken keen interest to promote research culture among students. The steps taken in this regard at the college level are listed below:

1. Constitution of a Research Committee to mentor and monitor research among students and to inculcate a scientific and research environment in the college
2. Research project for all students are carried out in the campus itself to make them more research oriented.
3. Training programs at different levels are organized to introduce upcoming technologies
4. Seed money provided by the college for selected student research projects under a scheme called Innovation Ideas Unleashed (I^2U) (About a dozen I^2 U projects are supported every year). This project competition among students began in 2011.
5. Encourage research paper presentations in National and International Seminars
6. Personal mentoring and guidance by the research supervisor throughout the research Process.
7. Scope for publishing eligible research results in the College Research journal, Amal Jyothi Technical Report.

These activities initiated by the college for promotion of research motivate students to think independently and go for self-learning and to learn their subjects of interest beyond syllabus

7.2.6. Career Guidance, Training, Placement, and Entrepreneurship Cell (5)

(Instruction: The institution may specify the facility and management to facilitate career guidance including counselling for higher studies, industry interaction for training/internship/placement, entrepreneurship cell and incubation facility and impact of such systems.)

Career guidance and placement of students

The college has a placement cell with 3 full time staff members, including a full time placement officer, to provide career guidance and placement training to students. The placement cell organizes on-campus and off-campus recruitments and pre-placement training programs in Aptitude test, Group Discussions, Interviews and presentation skills in collaboration with the Department of Humanities and other core departments. Mock interviews and GDs are conducted on a regular basis so as to equip final and pre-final students to face the challenges of recruitment scenario. Close on the heels of placement drives, the Placement Cell makes an evaluation of the performance of the students. This objective appraisal enables the college to identify strengths and weakness of the candidates and select strategies for improvement. Besides, there are intensive supportive measures for low performing candidates.

Career Counseling

Career guidance and motivational lectures by Alumni, External guests and faculty are organized frequently

Organizing coaching classes for competitive exams

The departments organize coaching classes for GATE examination. The placement cell organizes seminars on Higher Studies and conduct aptitude training.

Foundation Course for Civil Services is offered for interested students by Amal Jyothi Institute for Civil Services. Many books and periodicals are available in the library for the students to prepare for these examinations.

Skill Developments (Spoken English, Computer literacy etc.)

Communicative English has been incorporated into the curriculum. The Language Lab with a capacity of 66 consoles has been set up to compliment classroom teaching.

In addition to these, different departments conduct following add-on courses in their areas of specialization

Department	Add-on Courses
AUE	AutoCAD, Pro-E
CE	Revit architecture, Auto Cad, Primavera P3, STAAD Pro
CSE & CA	JAVA, PHP, Android, NS2, LATEX
ECE	Matlab, Embedded Lab (PIC and 89C51), Lab View, Placement opportunities, Aptitude training
EEE	CAD Training, MATLAB training

IT	Android, PHP, Java
ME	AUTOCAD, CATIA, ANSYS, PRO-E, ABAQUS TRAINING

A Question bank, containing close to 100000 questions, has been prepared by the faculty for the benefit of students. The students can access the question bank and practice answering them

Job-oriented skill development center, sponsored by Volvo-Eicher
In a first-of-its kind venture for an engineering college in Kerala, AJCE has signed up a MoU with the globally-renowned Volvo- Eicher Commercial Vehicles Ltd (VECVL) to establish a job-oriented skill development center.
Accordingly, the Amal Jyothi- Eicher Center for Automobile Technology, sponsored by VECVL, has been established in the Amal Jyothi campus. This is the first heavy-duty Automobile training center in Kerala run by an engineering college in association with a globally-reputed automobile manufacturer.
The skill development center will be a boon for the faculty and students to update themselves on the latest developments in automobile technology and to have a hands-on experience in best-of-its-class automobile technology in the world. It also offers a wonderful opportunity for scores of unemployed youth with class 10/12 education to get trained in automobile technology The Center will familiarize trainees in the most scientific way of repair, maintenance and overhauling of commercial vehicles. The college has earmarked a space of 900 m^2 to the center for state-of-the-art classrooms, workshop and library.

VECVL will train the trainers and conduct regular follow-up programs to faculty to update them on developments in the field of automobile technology. It will also provide study materials and training equipment for the course.
The course will be a blend of theory and practical sessions for nine months and VECVL will provide a 3-month internship at their plant and dealerships.

Innovation and Entrepreneurship Development Center (IEDC)

The Innovation and Entrepreneurship Development Center (IEDC) is an initiative of National Science and Technology Entrepreneurship Development Board (NSTEDB) of the Department of Science and Technology (DST), New Delhi. With an aim of develop institutional mechanism to create entrepreneurial culture in academic institutions to foster growth of innovation and entrepreneurship amongst the faculty and students.

Every year this center is providing financial support to number of students for developing innovative products. Up to one lakh rupees for each idea. Apart from this financial support we are providing the mentoring and Infrastructural support for these projects.

Also this center is arranging so many classes and camps to promote technology based innovation and entrepreneurship among the students.

Inspiration behind the starting IEDC

1. Our long-term goal is to create an engineering city of three hundred acres in area, owned by the management out of which the present campus occupies fifty acres and to develop a technological center to uplift the rural community.
2. Many of our students have shown consistent interest to get more knowledge about entrepreneurship to be competent in the modern world.

3. Our students and teachers have been proving their talent in developing innovative products by winning several national level project contests and getting funds for product development from various research and development institutes around the nation.
4. There are no other centers in our district or neighboring districts for guidance in the field of entrepreneurship.
5. The scope of rural technology development is very high because our college is located in a rural setting with most people depending on traditional farming methods.
6. Our management and empowered faculty members are trying to provide technology based solutions to the problems faced by the agrarian rural community and these efforts have been streamlined through IEDC.

Activities of IEDC

1. Business skill development program

Business Skill Development Programme (BSDP) is a training programme sponsored and supported by Ministry of Micro, Small Medium Enterprises (MSME), New Delhi. With an aim to encourage students to start self- employment ventures as Micro, Small or Medium enterprises which is instrumental for employment generation.

2. Product development

In association with various Government agencies and by utilizing the technical resources of Amal Jyothi College of Engineering, we have developed a good number of new innovative socially useful products. A few of the examples are listed below:

1. Intelligent Light Dimmer: In this fast growing era a lot of accidents are reported due to the temporary blindness created due to the High beam of the headlight of the vehicles coming in the opposite direction. Amal Jyothi has taken this nationally important problem as a challenge and developed an automatic light dimmer which will actuate without the help of human interference. This project was supported and sponsored by Government of Kerala.
2. Automated Rubber tapping machine: Kerala is a state having vast areas of rubber cultivation and all are facing huge labor shortage to tape the tree. To overcome this crises Amal Jyothi is developing an Automated Rubber tapping machine in association Rubber Research Institute of India (RRII)
3. Coconut Climbing Machine: Department of Industries and Commerce, Govt. of Kerala has organized a national wide competition for developing Coconut Climbing Machine, to avoid the acute labor shortage in this field. Form this competition eight ideas were selected for product development, out of this two projects are for Amal Jyothi College of Engineering. Those are 1. Mr John Jose Pattery, final year Mechanical Engineering. 2. Mr. Zacharias Mathew, Chief Technical officer.
4. Robo for Bore Well Rescue: A robot for rescuing children from tube well has developed by our students, this project is funded by Department of Science and Technology (DST), New Delhi, Govt. of India.
5. Pedal Powered Inverter: We developed an inverter which use mechanical power to charge the battery of the inverter, source of this mechanical power is pedaling of an exercises cycle; this project is funded by Department of Science and Technology (DST), New Delhi, Govt. of India.
6. Digital pre- paid energy meter: This is an energy meter which can charge like a pre- paid mobile and can control number of energy meters from one central station. This will help for

energy conservation also. This project is funded by Department of Science and Technology (DST), New Delhi Govt. of India.

7. Driver's Assistant: To make the drivers more alert about road sign boards, our students have developed a new equipment, which was funded by Department of Science and Technology (DST), New Delhi, Govt. of India.
8. Internet Radio: With an aim of promoting internet communication our students has started one internet radio which will be converted in to a technical knowledge source within a short span of time. This programme is taking place in association with Department of Science and Technology (DST), New Delhi, Govt. of India.

Technology-Business Incubator (TBI), sponsored by DST

A Technology-Business Incubator (TBI) has been established AJCE with the support of DST in 2014-15, with the following objectives:

1. Creation of Technology based incubates on a continuous basis
2. Help to create value added jobs and services
3. Introduction of entrepreneurial culture among students.
4. Create effective networking for the development of technology based start-ups
5. Develop internationally accepted technologies
6. Promote students to come up with commercially viable curriculum projects
7. Create student entrepreneurs
8. Create awareness about Technology Incubation and Commercialization of R & D products and processes.
9. Promote small and medium industries.

An overriding objective of the venture is to achieve a transformation of minds of students from being job-seekers to being entrepreneurs themselves, utilizing the theoretical and practical knowledge they gained in the college.
The TBI will initiate a stronger industry-academia-consumer linkage where ideas can flow to and fro through the three stakeholder groups so that everyone benefits. The industry will benefit from technological developments initiated by the TBI as well as qualified students who have an innovative mind to join their workforce. Academia will stand to gain from its constant interaction with industry, and consumers will gain from the innovations that are rolled out through the association.
The thrust areas identified for the functioning of TBI in AJCE are

1. Rural technology
2. Green Technology
3. Information Technology
4. Artificial Intelligence

Other entrepreneurial initiatives of AJCE

The college has identified entrepreneurship Development as the need of the hour in the context of growing opportunities for enterprises in India. Developing entrepreneurial traits in students is one of the graduate attributes. The following are some of the initiatives taken by AJCE, in addition to IEDC, in this direction.

It organizes special trainings like Business Skill Development Program (BSDP), Intellectual Property Rights Awareness, Entrepreneurship awareness Camps etc. in association with Techno Park, Trivandrum, Kerala State Council for Science, Technology and Environment (KSCSTE) and the Ministry of Micro, Small and Medium Enterprises (MSME), Govt. of Kerala. An IPR facilitation center supported by KSCSTE also functions in the college.
Two of the projects were shortlisted among the eight from Kerala and got funding of one lakh each from the State Govt. for developing a coconut tree climbing machine.

Three student projects are approved for TePP funding for product development. A few patent applications have been submitted through the Patent Information Center, KSCSTE, Govt. of Kerala.

Projects that won top place in the all-India Innovation Hub project contest, organized jointly by National Council of Science Museums and 'The Telegraph' at Kolkata

Project	Year	Prize
Password Security System	2007	First Prize
Electronic Wheel Chair	2008	First Prize
Solar Power-based Computerized Irrigation System	2009	First Prize
Robot Bore well Rescue	2010	Second Prize
Cocobot – Coconut Plucking Robot	2011	Second Prize
E- Diagnozer	2012	First Prize
Xerobot - A Multi-purpose Automation Robot	2013	Second Prize
Virtual-I	2014	First Prize
Automatic Lemonade Machine	2014	Second Prize

Projects that won positions in the all-India Tech Top project contest

Project	Year	Prize
Pepper Separator	2011	First Prize
Helioped	2011	Special Prize
Advanced cardamom drier	2013	Second prize
Virtual- I	2014	Special prize

Details of Amalites Entrepreneurs

Few of the alumni of AJCE who have initiated their own companies are listed below.

Entrepreneurship Initiatives	Batch	Dept	Name
Wedding Platter	2006	ECE	Sofia Anup
Emvigo Technologies	2007	ECE	Nitin Prabhakar
Emvigo Technologies	2008	ECE	AvinashPrabhakar
Zorus Technologies	2008	ECE	Syril Joseph
Dhuniya Al Jamali Group	2009	ECE	Hashim Jamal
Engineers World	2009	ECE	Rogen Joseph
Zhooyi Communications	2010	ECE	Mittu Andrews Tigi
Synergen Consultants	2010	ECE	Bansan Thomas George
Marigold Group	2011	ECE	Thomas Kiran
Developer of Fullforms.com	2006- 2010	EEE	Mithun Mathew
Electrical CAD	2006-2010	EEE	SajinBabu
Electrical CAD	2006-2010	EEE	SajinBabu
Kanchi Signature Collections- online store	2006 - 2010	EEE	Sruthi Merin Ittiyavirah
Mayoora Jewels- Handmade Terracotta Jewellery	2007 - 2011	EEE	Archana R Nair
Construction Company	2008-2012	CE	Arun George, Roshan E.E, Tigil Thomas
Filanza	2011	CSE	Sarath S
Construction Company	2006-2010	CE	Jobit Joseph
Construction materials business	2010-2014	CE	Shon Jacob

7.2.7. Co-curricular and Extra-curricular Activities (5)

(Instruction: The institution may specify the co-curricular and extra-curricular activities, E.g. NCC/NSS, cultural activities, etc.)

Promotion of Co-curricular and Extra-curricular Activities

The College views extracurricular and co-curricular activities as integral to the holistic development of students. Opportunities are identified, created and opened to promote student participation in them. Financial support as well as training and development support are provided by the institution appropriately. The college helps the students in these activities in the following ways.

1. Additional academic support and flexibility in examination times are provided.
2. Students are informed of Special dietary requirements, provided with sports uniform, necessary materials and other relevant information
3. Students organize three days National Techno Cultural fest Azure, Arts day, College day, Onam and Christmas celebrations.
4. A program called Talent ’EVE is conducted on year wise basis every two weeks to promote the talents of the students in campus.
5. All core departments have their own branch association. They organize seminars / workshops / invited talks from industry/inter college and intra college technical and cultural fest. Student chapters of various professional societies such as IEEE, CSI etc. function in the college.
6. With a view to honing the technical and cultural skills and talents of students, and to promote their aptitude for research and extension, the college offers both technical as well as non-technical clubs.
7. Students are given duty leave to participate in technical and cultural activities organized by the university or any other college.
8. For those who win the competition have been awarded the grace marks along with the internal marks

National Service Scheme (NSS)

The motto of NSS “Not Me, But You”, reflects the essence of democratic living and upholds the need for self-less service. NSS helps the students develop appreciation to other person’s points of view and also show consideration to ‘other living beings. The philosophy of the NSS is well reflected in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society on the whole and therefore, the NSS volunteers shall strive for the well-being of the society.

M.G University has sanctioned one unit of NSS to our college. This is the first time that an NSS unit has been sanctioned by the MG University to a self-financing engineering college. The NSS unit of our college, with 200 volunteers, plays an active role in shaping our student humane and responsible citizens. The overall aim of NSS is personality development of students through community service. We conduct special camping programme of seven days duration in adopted places and it provides unique opportunities to students for group living, collective experience sharing, sharing responsibilities, addressing various developmental issues of regional and national importance and close interaction with the community around.

Activities undertaken by the NSS unit of AJCE are listed below.

1. Road reconstruction
2. Yoga class
3. Class on self confidence
4. Cultural fest

5. Class on internal marks
6. Class on personality development
7. Debate ‘Love marriage or arranged marriage’
8. Blood group identification camp
9. Class for school students
10. Trekking
11. Class on energy conservation
12. X’Mas carol
13. Camp fire
14. Training on paper carry bag preparation
15. Visit to orphanage ‘Baby Sadhan’
16. Indoor games

Red Ribbon Club (RRC)

Red Ribbon Club Programme (RRCP) is a comprehensive promotional and preventive intervention to enhance voluntary blood donation as well as mainstream HIV and AIDS prevention, care and support and treatment impact, mitigation, stigma reduction, among the youth in educational institutions. It will also prepare and promote youth peer educators within and outside the campuses. An active RRC is functioning in Amal Jyothi College of engineering.

The activities of RRC includes

1. Blood donation
2. Blood group identification camp
3. HIV awareness programs

Nature Club

A nature club is a group of young people, who spread conservation awareness in the society. Since a club represents the collective will of its members, it can generate conservation awareness in most effective manner. A Nature Club functions in our college, which does everything possible (like organizing seminars) to spread awareness about conservation of nature.

Amal Jyothi Driving Academy

Road safety is a key concern for both Government and people on Indian roads. Safe driving today requires a higher level of confidence, competence and maturity, given the poor traffic planning, increasing number of vehicles, and lack of professionalism in driving and untrained drivers on road. In a bid to address these issues, Department of Automobile Engineering of Amal Jyothi, has launched Amal Jyothi Driving Academy, an initiative for promoting safe driving under the guidance and full support of Motor Vehicles Department. This Academy not just imparts better driving skills but also tries to inculcate safe driving culture through special theoretical sessions for behavioral training and road sense. The academy offers driving lessons to students with two vehicles available with it.
The motto of the Academy is “Smile while you drive”

A brief outline of co-curricular and extra-curricular activities for the past four years is given below.

2014 -15

All departments engage in activities like

- Industrial visits
- Invited lectures
- Department Association Activities
- Publication of department magazines / digests
- Career guidance talks
- Industry experts talks
- Workshops
- GATE / Placement Trainings etc.

A good number of students had appeared in technical festivals and project contests at state and national levels

5 projects from Amal Jyothi have been selected for Tech Top Competition held in Trivandrum

Team from Amal Jyothi secured first prize in *Shristi* – National Level Technical Project Contest in SaintGits College, Kottayam, Kerala. Close to 10 teams were finalists.

2 teams from Amal Jyothi secured the first and second prizes at Infocom, Kolkatta

Amal Jyothi hosted Azure, a national level techno-cultural festival during 25-27 September.

Dining Etiquette Sessions were conducted for students.

Over a Cup of Tea – An initiative of the Management Development Centre, noted industrialists and technocrats were brought in to address students to motivate them

Under the Fig Tree – A mini motivational / moral sessions led by the faculty of Amal Jyothi addressing the students.

NSS camps – Students attend the internally arranged camps and state and national camps

Community Service – Students as part of curriculum specifications engage in community services

College magazine is getting ready for publication

Amal Jyothi hosted Azure, a national level techno-cultural festival from September 25, 26 and 27

Onam – 5th September 2014 saw the conduct of Onam Celebrations.

Christmas Celebrations – The first year students hosted the Christmas Celebrations on 19th December 2014.

Talent EVE – 22nd August 2014 witnessed the conduct of Talent Eve – a biweekly programme conceptualised to promote the talents of the students.

Run Kerala Run - 20th January, Amal Jyothi joined the rest of Kerala in celebrating the organisation of National Games in the state by conducting a 1 km marathon around the campus premises

Arts Day Celebrations '*Aarohan 2K15'* was organised on 28th February which also saw playback singer Najeem Arshad as the Chief Guest at the closing ceremony.

Alumni Induction Programme for graduating students on 20th May 2015

Be Smart Don't Start – Anti Addiction campaign was organized by the Jesus Youth in the campus on 01, April 2015

Regular sports events in games and sports are conducted along the semester focusing on Shuttle Badminton, Basketball, football, cricket and athletics

2013-14

All departments engage in

- Industrial visits
- Invited lectures
- Department Association Activities
- Publication of department magazines / digests
- Career guidance talks
- Industry expert talks
- Workshops
- GATE / Placement Trainings etc

NSS camps – Students attend the internally arranged camps and state and national camps

Be Smart Don't Start – Anti Addiction campaign was organized by the Jesus Youth in campus on April 1 2014

Community Service – Students as part of curriculum specifications engage in community services

Amal Jyothi hosted '*Azure*', a national level techno-cultural festival from August 12, 13 & 14

Amal Jyothi hosted *'Arena'*, all Kerala Basketball tournament on 3-6 March 2014

Onam – 13th September 2013 saw the conduct of Onam Celebrations.

Christmas Celebrations – The first year students hosted the Christmas Celebrations 'Cake 13' on 13th December 2014.

Talent EVE – 17-01-2014 & 31-01-2014 witnessed the conduct of Talent Eve – a biweekly programme conceptualized to promote the talents of the students.

Arts Day Celebrations on 4 & 5 March 2014, El-Arte provided a platform for students to explore their talents and discover the artistic masteries. The event was inaugurated by Shri Ajay Kumar aka Guinness Pakru, a popular dwarf cine artist.

Alumni Induction Programme & Common farewell for graduating students on 26/04/2014

Regular sports events in games and sports are conducted along the semester focusing on Shuttle Badminton, Basketball, football, cricket and athletics

2012-13

All departments engage in

- Industrial visits
- Invited lectures
- Department Association Activities
- Publication of department magazines / digests
- Career guidance talks
- Industry experts talks
- Workshops
- GATE / Placement Trainings etc.

A good number of students appeared in technical festivals and project contests at state and national levels

The Onam celebration was conducted on 24th August 2012.

Fresher's Day welcoming first years to campus was conducted on 11th October.

Arts Club Inauguration was held on 11th October and the guests for the day were Shri V T Balram and Ratheesh Vega

Christmas Celebrations by the first years were held on 21-12-2012

Arena 2K13 fell on the dates 27th Feb to 2nd March and was inaugurated by Ms. Geethu Anna Jose, former captain of Indian Woman’s Basketball Team

Arts Day ‘Rang De’ was held on 15 and 16 March 2013

Department Fests: All departments conducted their department fests on 16th April 2013 to make it a unique day of conglomeration of talents.

Regular sports events in games and sports are conducted along the semester focusing on Shuttle Badminton, Basketball, football, cricket and athletics

College Magazine ‘Page 33’ was published.

2011-12

All departments engaged in

- Industrial visits
- Invited lectures
- Department Association Activities
- Publication of department magazines / digests
- Career guidance talks
- Industry experts talks
- Workshops
- GATE / Placement Trainings etc.

A good number of students had appeared in technical festivals and project contests at state and national levels

The Onam celebration was conducted on 2nd September 2011.

Christmas Celebrations by the first years were held on 23-12-2011

Arts Day and College day were held on 16th and 17th January, 2012 with the Art’s day inauguration getting done by Ms. Sarayu (cine artist). College day inaugurated by Dr. J. Prasad, Hon. Vice Chancellor, Sri Sankaracharya University, Kalady.

Arena and Azure: The year witness the prime events getting organized simultaneously from 26th to 28th January with Arena getting inaugurated by Mr. George Marness, Former International Player and Azure getting inaugurated by the Chief guests Shri. Shibu Baby John (Minister for Labour and food Supplies) and Shri. Sarath (Music Director).

Annual Sports Meet was conducted along the dates 29th to 31st March 2012

College Magazine 'Page 33' was published.

(Instruction: The institution may specify the co-curricular and extra-curricular activities, e.g. NCC/NSS, cultural activities, etc.)

7.2.8. Games and Sports, facilities, and qualified sports instructors (5)

(Instruction: The institution may specify the facilities available and the usage of the same in brief.)

Sports and Games is an integral part of Amal Jyothi's total education program. Amal Jyothi has been maintaining high standards in almost all games among engineering colleges in Kerala. We always have thrived hard to excel in the field of sports and games. Amal Jyothi College holds a very proud tradition of encouraging athletes and sports personnel in different fields. It has achieved the invincible track record in Sports and Games in M.G University. AJCE bagged the M.G university Shuttle badminton Women championship for four years continuously from 2003-04 to 2006-07. The Department is of Physical Education gives systematic training and coaching for players in various games throughout the year. In order to have competitive experience and exposures, Amal Jyothi teams participate in all the Inter Collegiate Sports and Games Tournaments. With a rich tradition in Basketball from its inception the college organizes ARENA, an All Kerala Intercollegiate tournament in Basketball [men & women] regularly since 2007.

Facilities for sports and games

The college has established a Physical Education Department under a Director, who is responsible for organizing various sports and games activities. The college has ample facilities for all major games, indoor and combative activities etc. It also has a very well furnished health club with excellent facilities for developing a fine and athletic body. The Health Club is open to students throughout the year.

Activities of Physical Education Department includes admission under sports quota through selection trials and Interview with certificate verification. It conducts coaching camp for each game during mornings and evenings for a minimum period of two months before any competition. The department fields Volleyball, Basketball, Football, Table Tennis (M & W), Badminton (M & W), and Cricket, Chess, and Wrestling (M) teams at University, Intercollegiate and State level competitions. Department seeks assistance from Kerala Sports Council and M.G. University regarding assignment of coaches for each game. Regular training is going on throughout the year for major games like Volleyball, Basketball, Football, Table Tennis, Badminton and Cricket. Department provides sports equipment, kit, TA and DA to the players participating in University and other inter-collegiate tournaments. Department not only look after the welfare and sports development of student, but also monitor their academic progress and moral. It also helps sports men and women to avail grace marks from University, scholarships from Sports Council, University, SAI and other funding agencies.

Conduct of Annual Sports Meet and Inter-Departmental Games competitions is another important activity of Physical Education Department.

The faculty of Physical education department provides necessary supervision and assistance to students and staff in all their sports related activities. The department also organizes matches between staff and students in Volleyball, Table Tennis, Basketball and Badminton.
The following facilities are available in the College for sports and games.

- 400 Meter Track (Under Construction)
- Athletics [200 meters Track with six lanes]
- All equipment for field events like shot put, javelin throw, discuss throw and long jump pit
- Cricket net practicing facility and cricket kit.
- Mini Football court
- Basketball courts (3 numbers) with gallery
- Volleyball court
- Indoor Badminton court and two Table Tennis Boards for boys and girls
- Chess board and chessmen
- Four Badminton Courts
- Weight lifting set
- Power lifting set
- Physical fitness center with 14 fitness systems etc.

The College hires the services of qualified coaches for different games. The college has a panel of coaches from where the Physical Education Department makes a selection of proper coaches as and when necessary. All coaches in the panel have reputation at University and State levels.

Student Achievements in Co-curricular, Extracurricular and cultural Activities

The details of major student achievements in co- curricular, extracurricular and cultural activities at different levels: University / State / Zonal / National / International for the past couple of years is listed below.

2013-2014

Achievements at National/Inter University Level

1. Dennis John (ECE) received Young Innovators Award in Infocom NCSM
2. Abhilash Anandan (ECE) and team reached final round of TechTop 2013
3. Sarath V Joy (S5 ME), selected to the MG University Table Tennis team.
4. Aswin Tom (S3 CSE), selected to the MG University Table Tennis team.
5. Rahul Binu Mathew (S1 S2 ME) selected to the MG University Table Tennis team.
6. Vishnu Surendran (S1S2 ME), represented MG University in the south Zone inter University Chess Championship held at SRM University Chennai.

Achievements at State Level

1. Abel Aby Kuriakose and team has won First for Best Choreography at St. GITs
2. Mathew M John has won first prize in Circuit Debugging at SaintGits
3. Arun Thomas and team has won first prize for Project Competitions at Carmel

College
4. Ajay P Joji and Bony M Jose has won second prize for Concept PPT at St. GITS
5. Denson K Shaji and team has won first prize at Robowar in Saintgits
6. Deepak Thomas won second prize in Asthra 2014 Arts fest at St.Joseph's Engineering College, Pala
7. Nithin Biju won second prize in Asthra 2014 Arts fest at St. Joseph's Engineering College, Pala.
8. Harikrishna S. P won first prize in Cricket at St. Joseph's Engineering College, Pala (PACE 14)
9. Asha Mary Raju won first prize in the Technical Quiz Contest at Musaliar college of Engineering
10. Jerin Babu won first prize in the Technical Quiz Contest at Musaliar college of Engineering
11. Amal Jyothi bagged the Overall Championship in the 'PACE 14' All Kerala Inter Collegiate Sports fest organized by St. Josephs college of Engineering, Pala
12. Amal Jyothi Volleyball team secured the First position in the 'PACE 14' All Kerala Inter Collegiate Sports fest organized by St. Josephs college of Engineering, Pala
13. Amal Jyothi Cricket team secured the First position in the 'PACE 14' All Kerala Inter Collegiate Sports fest organized by St. Josephs college of Engineering, Pala
14. Amal Jyothi Volleyball team secured the First position in the "MBC Trophy 14", All Kerala Inter Collegiate Volleyball tournament organized by Mar Baselious college of Engineering, Peerumedu
15. Amal Jyothi Volleyball team secured the First position in the "SMASH 14", All Kerala Inter Collegiate Volleyball tournament organized by IHRD college of Engineering, Kalluppara
16. Amal Jyothi Volleyball team secured the First position in the 'ASPIRE 2014' All Kerala Inter Collegiate Volleyball tournament organized by Amal Jyothi college of Engineering.
17. Amal Jyothi Basketball team secured the Second position in the 'ARENA 2014' All Kerala Inter Collegiate Basketball tournament organized by Amal Jyothi college of Engineering.
18. Amal Jyothi Table Tennis team secured the Second position in the All Kerala Inter Collegiate Invitational Table Tennis Championship organized by St. Alberts College, Ernakulam.

Achievements at University Level

1. Winners of MG University Table Tennis Tournament
2. Runners Up of MG University Chess Tournament

Achievements at Zonal Level

1. Fourth position in MGU KOTTAYAM South Zone Cricket
2. Winner of MGU KOTTAYAM South Zone Chess
3. Winner of MGU KOTTAYAM South Zone Table Tennis
4. Third position in MGU KOTTAYAM South Zone Basketball

2012-2013

Achievements at National/Inter University Level

1. Sarath V Joy (S3 ME) selected to MG University Table Tennis team and participated in the All India Inter University Championship held at Kannur University.

Achievements at State Level

1. Amal Jyothi Basketball team secured the Second position in the ‘ARENA 2013’ All Kerala Inter Collegiate Basketball tournament organized by Amal Jyothi college of Engineering
2. Amal Jyothi Chess team secured the First position in the All Kerala Inter Collegiate Chess tournament organized by SAINTGITS college of Engineering
3. Amal Jyothi Basketball team secured the second position in the ‘Rajagiri Trophy 2012’ All Kerala Inter Collegiate Basketball tournament organized by Rajagiri College of Engineering, Ernakulam
4. Overall Champions in ‘PACE 2013’ Organized by SJCET, Pala
5. Football Champions in ‘PACE 2013’
6. Cricket Champions in ‘PACE 2013’
7. Basketball Champions in ‘PACE 2013’
8. Volleyball Runner Up in ‘PACE 2013’
9. Badminton Champions in ‘PACE 2013’

Achievements at University Level

1. Neenu Jose secured "A Grade" in MG university festival
2. Joel P Jacob participated in Mechanical Quiz Competition and won first place held at Musaliar College of Engineering
3. Joel P Jacob participated in ROBOWARS and got first place in Muzaliar college of Engineering
4. Tojo K Jose participated in MG University youth festival in Daffmutt Competition and won second place
5. Ajith A participated in duet singing at M A College of Engineering conducted in connection with Sanskriti-2013; he was awarded Second prize for the same
6. Divine George Ninan Participated in MACHINE MAYAA- Robo war competition at Govt Engineering College Painavu, and got First prize
7. Second position in M.G University Chess Tournament
8. Second position in M.G. University Table Tennis Tournament
9. Fourth position in M.G. University Inter Zone Basket Ball Tournament

Achievements at Zonal Level

1. Winner of MGU KOTTAYAM South Zone Chess tournament
2. Winner of MGU KOTTAYAM South Zone Table Tennis Tournament
3. Third position in South Zone Basketball tournament
4. Fourth position in South Zone Cricket tournament

(Instruction: The institution may specify the facilities available and the usage of the same in brief.

8. Governance, Institutional Support and Financial Resources (75)

8.1. Campus Infrastructure and Facility (10)

8.1.1. Maintenance of academic infrastructure and facilities (4)

(Instruction: Specify distinct features)

Amal Jyothi College of Engineering (AJCE), Kanjirappally is spread over an area of nearly 70 acres, with built up area around 1.5 Lakh sq. mtrs.

a) Facilities for Curricular and Co-curricular Activities

Class rooms

AJCE has over 80 class rooms spread over 6Blocks: Resource block, Central Complex, Divisional Blocks A, B and C and Research square. All class rooms are ergonomically designed to reinforce a student-centered style of instruction. The spacious, airy and well-furnished class rooms provide the right atmosphere for developing proper study habits and extending the attention span to the full session.

All the UG classrooms have a capacity to accommodate 70 students. All class rooms have ceiling mount LCD projectors, Notice Boards, Lecture Stand, Uninterrupted Power Supply from a centralized UPS, wooden tables, Centralized Public Announcement System, black board, PAS system and wooden benches.

Technology enabled learning spaces

Wi-Fi campus

The College campus and student hostels have 24x7 Wi-Fi connectivity

Knowledge Center

The Knowledge Centre of AJCE is meant to equip students and staff to go beyond the limits of class room learning. This imposing edifice of 5000 sq. mtr. Comprise of five floors, three of which are dedicated for the Central Library. The Knowledge Center affords technology resources and academic support to students and staff for research activities, training sessions, CAD laboratory, Language lab, Internet browsing, Software development etc. The rental section occupies the ground floor of the Central Library. The first and second floors house the reference section and reading rooms for UG and PG students, respectively.

A Central Computing Facility, established on the third floor of the Knowledge Center, is divided into 5 labs and seminar halls. 250 workstations are provided for the net savvy. Internet @100 mbps is provided through dedicated OFC cable.

The top floor of the Knowledge Center accommodates a multi-purpose Auditorium, seating 800, employing cutting edge audio-visual, videoconferencing and distance-learning facilities for various purposes.

Conference Halls

AJCE has state-of-the-art conference halls, set up in the Resource Block, Central Complex, Divisional Blocks, Knowledge Centre and the Guest House, with following capacities.

1. Resource Block: 25 seats, air conditioned
2. Central Complex: 200 seats, air conditioned
3. Guest House: 15 seats and 50 seats, both air conditioned
4. Knowledge Centre: 50 seats, air conditioned
5. Divisional Block C: 120 seats, air conditioned
6. Divisional Block A: 70 seats, air conditioned
7. Divisional Block B: 120 seats, air conditioned
8. Research Square: 120 seats, air conditioned

Auditoria

There are 4 auditoriums on the campus with the following capacities

1. Resource Block: 750 seats
2. Knowledge Centre: 800 seats
3. Divisional Block C: 1200 seats + gallery
4. Open air theatre: 2000 seats + gallery

These are equipped with Dolby woofer sound system, stage curtains, accessories etc.

Laboratories

1) Auto Chassis Lab
2) Reconditioning Lab
3) Heat engines lab
4) Fuels and lubricants lab
5) Auto electrical and electronics lab
6) Survey lab
7) Materials testing lab
8) Geotechnical engineering lab
9) Concrete Laboratory
10) CAD Lab
11) Transportation Engineering Lab
12) Environmental engineering lab
13) Project Lab
14) Advanced Systems Lab
15) Programming Lab
16) Network Lab
17) M. Tech Lab
18) DBMS Lab
19) Internet &Multimedia Lab
20) Programming Lab
21) Fluid Mechanics & Hydraulic Machines Lab
22) Heat Transfer Lab
23) Mechanical Engineering Laboratory
24) Machine tool Laboratory

25) Advanced Machine tool Laboratory
26) Heat Engines Laboratory
27) Metrology & Mechanical Measurements Laboratory
28) Computer Labs MCA
29) Computer Labs IT
30) Electronics Labs ECE
31) Electrical Labs EEE
32) Electronics Labs EEE
33) Metallurgy Labs
34) Chemical Engg Labs

b) Facilities for Extra–Curricular Activities

Facilities for Athletics
Facilities for outdoor games
Facilities for indoor games
Gymnasium

Health Club

'A Healthy mind in a Healthy body' – so goes the adage. The Health Club houses an ultra-modern gymnasium, 2000 square feet in plinth area, catering to the needs of the fitness enthusiasts. Staff and students are free to use the gymnasium after class hours under the tutelage of professional trainers. State-of-the-art equipment available include bench press, peck deck, bicep curl, lateral pulley and body twister machines.

Chapels

For a short withdrawal from the busy working life, far from the madding crowd's ignoble strife, for a moment of quiet reflection and prayer, there are chapels with a serene space of elegant design, both at the College and at the two campus hostels.

Maintenance of academic infrastructure and facilities

An excellent system is in place at AJCE for the maintenance of its infrastructure facilities. The management pays very serious attention to the maintenance of the campus and the buildings. The college maintains a beautiful campus with wide internal roads and lawns.

Green litter-free campus: AJCE maintains a green campus with trees and plants all around. The campus is litter free with dust bins provided at several locations. The staff and students are in tune with the attitude of the management and take good care of the campus.

Plastic free campus: AJCE is proud to maintain a plastic free campus. Plastic waste is put in dust bins which are cleared every day.

The management also takes good care of the buildings in the campus, with periodic painting and maintenance.

8.1.2. **Hostel** (boys and girls),**transportation facility, and canteen**(2)

One of the attractions of AJCE is the excellent hostel facility. The two campus hostels, Santhom for gents and Amala for ladies, are taken care of by dedicated Catholic Priests and Sisters. There is land telephone access to all rooms. However mobile phones are not permitted for students in the college or hostels. Affectionate discipline, tasty food at moderate rates and neat rooms with modern sanitation and professional laundry services are the hallmarks of the Amal Jyothi hostels**.**

A long skywalk, nearly 0.5 km in length, takes girls from academic blocks to their hostel directly. Another sky walk connects the third floor of Block C to fourth floor of boys' hostel. These skywalks save time for students, especially during lunch time.

Hostels	No. of rooms	No. of students accommodated
Hostel for Boys:	600	1200
Hostel for Girls:	600	1200

A few teachers are also provided single room accommodation in the hostels.

Since AJCE is envisaged as a residential institution with hostel facility provided to most students, the college does not ply its buses regularly to bring in or take away students. Moreover, the public transport facility is very good in the region. So the college does not provide regular transport facility for students or staff. However, the college has two buses which ply to Kanjirappally town in the mornings and evenings to bring in and take out staff and students.

The college has an excellent canteen where needed students and staff can take food and beverages. The canteen provides breakfast, lunch and dinner at defined timings. The canteen possess modern food preparation facilities and is maintained very clean and tidy. The college possesses a centralized kitchen where food is prepared for nearly 3000 inmates of the campus. This central kitchen possesses all modern gadgets and amenities to prepare and cook food.

8.1.3. Electricity, power backup, telecom facility, drinking water, and security (4)

(Instruction: Specify the details of installed capacity, quality, availability, etc.)

Electric power

Power availed from KESB Ltd at HT level (HT Service Connection.)
Contract Demand : 350 kVA
Recorded maximum demand : 290 k VA
KSEB substation functioning in the campus

Power back up

Backup Power sources	: DG Sets	(1) 380kVA (2) 160 kVA (3) 82.5 kVA
Solar Photovoltaic Power plant	: 100kVA	

All the systems are performing well
Backup power sources are working on AMF panel (Auto Mains Failure Panel)
Hence duration of power interruption on failure of the KSEB Ltd supply is only 30 seconds.

Telecom facility

Telephones of two service providers are available-BSNL and Reliance.
Intercom facility is available at all work stations and all senior faculty members
All the hostel rooms have telephone facility.

Drinking water

Purified clean drinking water is available at several locations in the campus. Purified (UV irradiated and filtered) drinking water is collected in SS tanks provided with taps and tumbler. The facility is provided in hostels as well.

Security

Security is available on a 24x7 basis in the campus. Two security officers are posted at the two main gates of the college and are available all the time. Security is provided in hostels also. The security arrangements make the campus very safe for students and staff, particularly for women. Due to these arrangements no untoward incident of any kind has occurred in the campus during the past 15 years of existence of the institution.

8.2. Organization, Governance, and Transparency *(10)*

8.2.1. Governing body, administrative setup, and functions of various bodies (2)

(Instruction: List the governing, senate, and all other academic and administrative bodies; their memberships, functions, and responsibilities; frequency of the meetings; and attendance therein, in a tabular form. A few sample minutes of the meetings and action-taken reports should be annexed.)

Amal Jyothi College of Engineering (AJCE) is governed by the Educational Trust under the Catholic Diocese of Kanjirappally, Kottayam, Kerala with the Bishop of Kanjirappally Diocese as the Patron. Major decisions on the functioning of the college are taken by the Governing Body whose members are Patron, Vicar General, Finance Officer, Vicar of the

Kanjirappally Cathedral, a Chartered Accountant, Manager and Principal of the college and other eminent personalities, nominated by the Bishop.

College activities and policy decisions regarding academic matters are taken by the Academic Council of the college. Members of the Academic Council are Principal (Chairman), Dean (Academic), Dean (Research), Dean (Administration), Heads of all Departments and Senior Professors. Academic council meets every alternate Wednesday afternoons.

Manager of the college, who is a priest, is the representative of the patron and is responsible for financial and resource planning.

8.2.2. Defined rules, procedures, recruitment, and promotional policies, etc. (2)

(Instruction: List the published rules, policies, and procedures; year of publications; and state the extent of awareness among the employees/students. Also comment on its availability on t h e Internet, etc.)

Service rules, policies and procedures for the institution are in place and documented. They are made known to all newly recruited staff members through an induction program. It is modified as and when the need arises. Important information are informed through circulars and during staff meetings. Circulars are sent to all staff members through e-mails. Various guidelines and procedures are shared among all staff members for information as a google document.

8.2.3. Decentralization in working, including delegation of financial power and grievance redressal system (3)

(Instruction: List the names of the faculty members who are administrators/decision makers for various responsibilities. Specify the mechanism and composition of grievance redressal system, including faculty association, staff-union, if any.)

A well decentralized pattern of working is followed at AJCE. Though the Principal is the academic head of the institution, many of his powers are delegated to Heads of Departments and other officers for efficient functioning. There are three deans below the Principal who are in charge of various activities as listed below. The Heads of Departments are in charge of their departments. The delegation of power among various officers is as given below.

1. Dean (Academic) – Academic matters, faculty appraisal, faculty recruitment, verification of work registers, follow up of academic progress, course files, monograms, student discipline, minutes of Academic Council, recommendation of leave etc.
2. Dean (Research) – Professional Clubs, Research projects, project contests, correspondence with funding agencies, technical consultancy, business computing etc.
3. Dean (Administration) – Formulation of rules, policies and procedures, salary, pay revision, circulars, staff recruitment, pay fixation, resource planning, purchase and payments, new courses, mandatory disclosure, compliance report, issue of certificates, stock verification, website updation, student diary, student journal etc.
4. HOD, AU – In charge of Department of Automobile Engineering, Eicher ATC, CNC Training, Driving Academy

5. HOD, CA - In charge of Department of Computer Applications, Academic Enterprise solutions, hostel warden, admissions, career enhancement cell
6. HOD, CE - In charge of Department of Civil Engineering Secretary, Amal Jyothi Educational and Charitable Society
7. HOD, CH - In charge of Department of Chemical Engineering
8. HOD, CSE – In charge of Department of Computer Science & Engineering, Student Admissions, College Brochure, Ekalavya e-Outreach program
9. HOD, ECE – In charge of Department of Electronics and Communication Engineering, Alumni Association, IQAC
10. HOD, EEE- In charge of Department of Electrical and Electronics Engineering, Amalites Digest
11. HOD, IT - In charge of Department of Information Technology
12. HOD, ME - In charge of Department of Mechanical Engineering, Master Mind project contest
13. HOD, MT - In charge of Department of Metallurgy, BRNS project, KEMPPI welding training center
14. HOD, BS - In charge of Department of Basic Sciences (Mathematics, Physics and Chemistry)
15. HOD, Humanities- In charge of Department of Humanities, College publications, Soft Skill Development
16. Dr. Abin Manoj- First Year Coordinator, Exam cell and Staff Secretary
17. Prof. Sherin Sam Jose - Coordinator, IEDC, TBI, Science Excursion
18. Placement officer – Placement, Soft Skill Development, Public Relations
19. Dr. Jacob Philip - Research Guide, NAAC/NBA accreditation coordinator, Projects coordination
20. Dr. Job Kurian - TBI, Student training
21. Dr .K. Karunakaran Nair - Coordinator (PG Programs), PTA
22. Mr. Joe Scaria - Management development centre, Orientation programs for staff and students.

Departments are provided with ‘Department Fund’ and ‘Petty Cash a/c’ which can be utilized for student welfare, facility maintenance and minor purchases.

Grievances can be directed to the Staff Secretary who will bring it to the notice of the Academic council wherein it is discussed and suitable solutions arrived at. Complaints regarding infrastructure can be registered through an online complaint register, job orders are issued by Dean (Admin) to maintenance / construction staff. Suggestion box is kept outside the office of the Principal, in which staff and students can deposit their grievances / suggestions.

8.2.4. Transparency and availability of correct/unambiguous information (3) (Instruction: Availability and dissemination of information through the internet. Provision of information in accordance with the Right to Information Act, 2005)

The college maintains transparency in all its operation and working. Information such as Internal marks scored by students, Shortage of attendance, if any, Availability of scholarships, Opportunities for students etc. are promptly displayed on Notice Boards.

At the end of every semester faculty has to give an individual Semester work report, which helps faculty to evaluate their own performance during the period of the report. Criteria for student scholarships, faculty awards etc. are informed well in advance so that equal opportunity is given to all individuals concerned.

At the beginning of every academic year the college brings out a calendar, which contain all the information, including Mobile numbers of all faculty members, required by a student to carry out his/her studies in the college. Information about every activity in the college are sent to all staff and students through e-mail. Other publications such as *Amalites Digest* are also there to disseminate information about the college.

All the required information about the college are made available, as per directions of AICTE, in the college website:,www.amaljyothi.ac.in.
Information sought under RTI act is promptly furnished by the Principal/Manager.

8.3. Budget Allocation, Utilization, and Public Accounting (10)

Summary of current financial year's budget and actual expenditure incurred (for the institution exclusively) of the three previous financial years. **Rupees in lakhs.**

Item	Budgeted in CFY (2014-15)	Expenses in CFY (till 31.12.2014)	Expenses in CFY*m*1 (2013-14)	Expenses in CFY*m*2 (2012-13)
Infrastructural built-up	1000	631.14	2129.66	1542.40
Library	39.23	37.49	28.18	25.36
Laboratory equipment	210.77	117.36	194.33	146.28
Laboratory consumables	6.00	7.68	4.98	4.79
Teaching and non-teaching staff salary	1200.00	860.69	1046.88	847.45
R&D	9.00	6.43	9.31	8.47
Training and Travel	12.00	2.93	2.44	1.90
Other, specify	240.35	131.85	387.99	254.92
Total	**2717.35**	**1795.57**	**3803.77**	**2831.57**

(Instruction: The preceding list of items is not exhaustive. One may add other relevant items, if applicable.)

8.3.1. Adequacy of budget allocation (4)

(Instruction: In this section, the institution needs to justify that the budget allocated over the years was adequate.)

Budget requirements under 'recurring' and 'non-recurring' heads are collected from every departments and sections before the commencement of the financial year. Allocations are made as per the availability of funds. Spending is monitored by the accounts section. Supplementary allocations are made in special cases. The institution carefully monitors the expenses so that the necessities are met without affecting the smooth working of the institution. The management has been very efficiently doing this over the past several years that the institution never had any serious budget crunch that affected the functioning of the college.

8.3.2. Utilization of allocated funds (5)

(Instruction: Here the institution needs to state how the budget was utilized during the last three years)

Funds are allocated by the Manager of the College. Department Heads / Section-in-charges are intimated of the extent of funds allocated against their budget proposals.

Major works like construction, up-gradation of existing infrastructure, procurement and maintenance of common utilities, house-keeping, procurement of furniture etc. are controlled directly by the Manager.

Actions for procurement of lab equipment, up-gradation of existing lab facilities, purchase of consumables etc. are initiated from the respective departments and the funds are released on a case by case basis from the accounts office of the college on approval by the Manager.

During the last three years, the budget was utilized to meet expenses such as staff salary, infrastructure development, purchase of equipment, expenses towards consumables and contingencies, travel etc. Every year almost 75% of the budget is spent on staff salary, 10% on infrastructure development, about 8% on purchase of equipment, about 5 % on library development and the rest 2% on other expenses. This has been the general pattern of utilization of budget for the last 5 years.

8.3.3. Availability of the audited statements on the institute's website (1)

(Instruction: In this section, the institution needs to s t a t e whether the audited statements are available on its website.)

As of now, the audited statements of accounts of the college are not made available on the college website. However, this can be done with the permission of the Governing body and the Manager of the college.

(As on date it is not published in our website. It can be published with the permission of the Manager)

8.4. Programme Specific Budget Allocation, Utilization (10)

Summary of budget for the CFY and the actual expenditure incurred in CFY*m*1 and CFY*m*2 (for this programme exclusively in the department):

8.4.1. Adequacy of budget allocation (5)

(Instruction: In this section, the institution needs to justify that the budget allocated over the years was adequate.)

Items	Budgeted in CFY	Actual expenses in CFY (till ...)	Budgeted in CFYm1	Actual Expenses in CFYm1	Budgeted in CFYm2	Actual Expenses in CFYm2	Budgeted in CFYm3	Actual Expenses in CFYm3
Laboratory equipment	2.35	2.5	3.18	1.59	21.78	36.88	11.11	5.25
Software	2.00	7.00	1.00	NIL	1.0	NIL	4.00	3.32
Laboratory consumables	1.25	0.63	1.12	0.69	1.0	0.93	0.89	0.59
Maintenance and spares	0.25	0.01	0.25	0.09	0.5	0.19	0.30	0.22
Travel	0.15	0.05	0.15	0.08	0.05	0.1	0.07	0.05
Miscellaneous expenses for academic activities	1.5	0.95	1.5	1.35	1.25	1.1	0.12	0.06
Total	7.5	11.14	7.2	3.8	25.58	39.2	16.49	9.46

Budget requirements under 'recurring' and 'non-recurring' heads are collected from every departments and sections before the commencement of the financial year. Allocations are made as per the availability of funds. Spending is monitored by the accounts section. Supplementary allocations are made in special cases. The institution carefully monitors the expenses so that the necessities are met without affecting the smooth working of the institution. The management has been very efficiently doing this over the past several years that the institution never had any serious budget crunch that affected the functioning of the college.

8.4.2. Utilization of allocated funds (5)

(Instruction: In this section, the institution needs to state how the budget was utilized during the last three years.)

Funds are allocated by the Manager of the College. Department Heads are intimated of the extent of funds allocated against their budget proposals.

Actions for procurement of lab equipment, up-gradation of existing lab facilities, purchase of consumables, furniture etc. are initiated from the department and the funds are released on a case by case basis from the accounts office of the college on approval by the Manager.

During the last three years, the budget was utilized to meet expenses like purchase of equipment, expenses towards consumables and contingencies, etc.

8.5. Library *(20)*

8.5.1. Library space and ambience, timings and usage, availability of a qualified librarian and other staff, library automation, online access, networking, etc. (5)

(Instruction: Provide information on the following items.).

Carpet area of library (in m^2) – 2973 sq. m
Reading space (in m^2) -744 sq. m
Number of seats in reading space -110 sq. m.
Number of users (issue book) per day -150
Number of users (reading space) per day - 17
Timings: During working day - 8.00 AM to 8.00 PM
Weekend- Saturday: -8.00 AM to 5.00 PM,
Sunday: 10.00 AM to 4.00 PM
Vacation - 8.00 AM to 8.00 PM
Number of library staff: -7
Number of library staff with a degree in Library Management -6
Computerization for search, indexing, issue/return records - Yes
Bar coding used - Yes
Library services on Internet/Intranet - Yes
INDEST or other similar membership archives - Yes

8.5.2. Titles and volumes per title (4)

Number of titles**....12903**... .Number of volumes.........**31561**........up to **20-3-2015** (Central Library)

	Number of New Titles added	Number of new editions added	Number of New Volumes added
CFYm2	802	404	1254
CFYm1	493	520	979
CFY	753	322	1039

I8.5.3. Scholarly journal subscription (3)

Details		CFY (14-15)	CFYm1 (13-14)	CFYm2 (12-13)	CFYm3 (11-12)
Science	As soft copy				
	As hard copy	6	10	9	8
Engg. and Tech.	As soft copy	716	676	676	620
	As hard copy	133	116	109	90
Pharmacy	As soft copy				
	As hard copy				
Architecture	As soft copy				
	As hard copy				
Hotel Management	As soft copy				
	As hard copy				

8.5.4. Digital Library (3)

Availability of digital library content: Reinstalling under process
If available, mention number of courses, number of e-books, etc.
Availability of an exclusive server: Yes
Availability over Intranet/Internet: Yes
Availability of exclusive space/room: Yes
Number of users per day: 30

8.5.5. Library expenditure on books, magazines/journals, and miscellaneous content (5)

Year	Expenditure (Rs.)				Comments, if any
	Books	Magazines/ journals (for hard copy subscription)	Magazines /journals (for soft copy subscription)	Misc. Contents	
CFYm2	866256	322783	1589707	372772	Building, Extension Works etc… not included
CFYm1	1310225	338184	1700860	20416	
CFY	1071602	311860	3169596	472213	

8.6. Internet (5)

Name of the Internet provider: **Reliance and BSNL**
Available bandwidth: Access speed: **Reliance100 Mbps / BSNL 10 MBPS**
Availability of internet in an exclusive lab: **Exclusive Internet Lab with 200 systems**
Availability in most computing labs: **17 Department labs with Internet facility.**
Availability in departments and other units: **Staff rooms are equipped with wired internet and Corridors and lobbies are equipped with Wi-Fi connectivity.**
Availability in faculty rooms: **1:1 computers are made available for faculty**
Institute's own e-mail facility to faculty/students: **Yes (@amaljyothi.ac.in for faculty and @ajce.in for students)**
Security/privacy to e-mail/internet users: **Cyberoam 2500 ING 24hrs Wi-Fi internet is available inside the college campus.**
Internet is available in Hostels from 4.00am to 7.15pm.
(Instruction: The institute may report the availability of internet in the campus and its quality of service.)

8.7. Safety Norms and Checks (5)

8.7.1. **Checks for wiring and electrical installations for leakage and earthing** (1)

The following procedures are in place for the safe functioning of electrical installations in the college.

1. Reviews/Inspections are arranged periodically.
2. All electrical equipment and components, are inspected and approved by competent authority
3. Insist to observe codes, standards, and regulations.
4. Ground fault circuit interrupters are provided.

5. Formal training and awareness programs are arranged.
6. Working space around electrical equipment are maintained properly.
7. Means for identification of disconnection are provided.
8. Labeling of source, feeders and load are provided.
9. Work instructions and supervision are provided.
10. Electrical Personal Protective Equipment (PPE) such as rubber gloves, safety shoes, hats etc. are provided.

8.7.2. Fire-fighting measurements: Fire-fighting measurements: Effective safety arrangements with emergency /multiple exits and ventilation/exhausts in auditoriums and large classrooms/laboratories, fire-fighting equipment and training, availability of water, and other such facilities. (1)
Effective safety measures such as multiple exits and ventilation are provided in all class rooms, laboratories and auditoria

Firefighting equipment such as fire buckets, carbon dioxide cylinders, foams etc. are provided. Technical personnel in laboratories are made aware of the use these equipment.

Availability of water, in case of emergency, is ensured

8.7.3. Safety of civil structure (1)

The following measures have been taken for the safety of civil structures.

1. Civil structure are constructed with adequate design features to bear all natural calamities
2. Proper and periodical preventive maintenance are arranged.
3. Adequate water draining facility is provided.
4. Leak proofing and weather proofing measures are taken periodically.
5. Adequate lightning protection devices are installed.
6. Fire hydrants and fire extinguishers are provided in high rise buildings.

1.7.4. Handling of hazardous chemicals and other such activities (2)

(Instruction: The institution may provide evidence that it is taking enough measures for the safety of the civil structures, fire, electrical installations, wiring, and safety of handling and disposal of hazardous substances. Moreover, the institution needs to show the effectiveness of the measures that it has developed to accomplish these tasks.)

The following safety precautions and measures have been taken for the safe handling of hazardous chemicals, and for other activities requiring such measures.

1. While working in chemical laboratory always more than one person will be engaged.

2. Provided required personal protective equipment. Eye protection is very important and provided
3. Labeling of all containers with chemical contents.
4. Awareness given to all concerned to keep hands and face clean whenever they leave the lab.
5. Instructions given to avoid direct contact with any chemical and always wear a laboratory coat.
6. Keep chemicals off hands of laboratory personnel, face and clothing, including shoes.
7. Never smell, intentionally inhale or taste a chemical.
8. Smoking, drinking, eating and application of cosmetics is forbidden in areas where hazardous chemicals are used or stored.
9. Always use chemicals with adequate ventilation or in a chemical fume hood. Refer to the MSDS and the Standard Operating Procedure to determine what type of ventilation is needed.
10. Use hazardous chemicals only as directed and for their intended purpose.
11. Inspect equipment or apparatus for damage before adding a hazardous chemical. Do not use damaged equipment.
12. **Never** use mouth suction to fill a pipette. Use a pipette bulb or other pipette-filling devices.
13. Electrically ground containers using approved methods before transferring or dispensing a flammable liquid from a large container.

8.8. Counseling and Emergency Medical Care and First aid *(5)*

Availability of counseling facility (1)

Counselling facility is available for students at the following three levels

Academic Counseling:
Each faculty member is entrusted with 20 students to keep track of their progress and performance. Class committee meetings are conducted frequently to know the problems of students

Personal Counseling:
There are three professional counsellors in the College. Students are free to approach these councilors for help and support. Also the students can contact their respective faculty mentor for guidance on any issue affecting them.

Career Counseling:
Career guidance and motivational programs by Alumni, External guest and faculty are

organized often.

Career and placement cell of the college under the guidance of a Placement officer offers career counseling.

Psycho-social Counseling:
Psycho- social counseling is provided through various programmes like retreat, social service etc.

In order to equip the mentors for effective mentoring, AJCE has organized a Mentorship Training Programme. Training was imparted to mentors by experts from outside.

Arrangement for emergency medical care (2)

Necessary medical facilities for emergency medical care are available.
A 30 bedded hospital (Holy Cross Hospital, Koovappally) is available very adjacent to the campus. Full time doctors (2), nursing staff (4), pharmacist, X-ray technician, lab technician and clerical staff man the facility. A modern hospital (Mary Queens Mission Hospital, 26th mile, Kanjirapally) with all modern facilities like MRI and CT Scan is just 4 km away. It has most of the specialized departments manned with about 20 doctors and supporting staff. Vehicle service is available 24hours at this hospital. This hospital is equipped with Ambulance service.
Vehicles are available in the college to transport anybody to any of these nearby hospitals.

Availability of First-aid unit (2)

First-aid units are made available in the central building (Resource block) as well as in individual departments.

(Instruction: The institution needs to report the availability of the facilities discussed here.)

9. Continuous Improvement (100)

This criterion essentially evaluates the improvement of the different indices that have already been discussed in earlier criteria.

From 9.1 to 9.5 the assessment calculation can be done as follows.

a, b and c are the values of variables, which correspond to either LYGm2, LYGm1 and LYG or CAYm2, CAYm1 and CAY respectively, after scaled down each of them to a maximum value of
1.

For 9.1 and 9.2 the assessment can be made as,

Assessment = (b-a) + (c-b) + (a+ b+ c) x (5/3)

9.1 Improvement in Success Index of Students (5)

From 4. 1
a, b and c are the success indices which correspond to LYGm2, LYGm1 and LYG respectively.

Items	LYG (c)	LYG*m*1 (b)	LYG*m*2 (a)	Assessment
Success index	0.456	0.573	0.48	2.491

9.2 Improvement in Academic Performance Index of Students (5)

From 4. 2
a, b and c are calculated respectively for LYGm2, LYGm1 and LYG by dividing the API values, obtained from the criterion 4.2, by 10. The maximum value of a, b, and c should not exceed one.

Items	LYG (c)	LYG*m*1 (b)	LYG*m*2 (a)	Assessment
API	0.723	0.71	0.673	3.56

For 9.3 to 9.5 the assessment can be made as,

Assessment = (b-a) + (c-b) + (a+ b+ c) x (10/3)

9.3 Improvement in Student- Teacher Ratio (10)

From 5. 1

a, b and c are calculated respectively for CAYm2, CAYm1 and CAY by dividing the STR values, obtained from the criterion 5.1, by 15. The maximum value of a, b, and c should not exceed one.

Items	CAY (c)	CAY*m*1 (b)	CAY*m*2 (a)	Assessment
STR	0.6686	0.8146	0.626	7.073

9.4 Enhancement of Faculty Qualification Index (10)

From 5. 3

a, b and c are calculated respectively for CAYm2, CAYm1 and CAY by dividing the FQI values, obtained from the criterion 5.3, by 10. The maximum value of a, b, and c should not exceed one.

Items	CAY (c)	CAY*m*1 (b)	CAY*m*2 (a)	Assessment
FQI	0.964	0.718	0.958	8.806

9. 5 Improvement in Faculty Research Publications, R&D Work and Consultancy Work (20)

From 5.7

a, b and c are calculated respectively for CAYm2, CAYm1 and CAY by dividing the FRP values, obtained from the criterion 5.7, by 20. The maximum value of a, b, and c should not exceed one.

Items	CAY (c)	CAY*m*1 (b)	CAY*m*2 (a)	Assessment
FRP	0.0165	0.237	0.091	1.0738

From 5.9

a, b and c are calculated respectively for CAYm2, CAYm1 and CAY by dividing the FRDC values, obtained from the criterion 5.9, by 20. The maximum value of a, b, and c should not exceed one.

Items	**CAY (c)**	**CAY*m*1 (b)**	**CAY*m*2 (a)**	**Assessment**
FRDC	0.078	0.03	0.0305	0.5091

9.6 Continuing Education (10)

In this criterion, the institution needs to specify the contributory efforts made by the faculty members by developing course/laboratory modules, conducting short-term courses/workshops, etc., for continuing education during the last three years.

Module description	Any other contributory institute /industry	Developed/ organized by	Duration	Resource persons	Target audience
Training on ABAQUS	-	HOD	One week	Subin P George, AP	B. Tech. students and staff
Training on Auto CAD, CATIA	--	HOD	120 days	Rony Scaria *international trainer*	B. Tech. students
PRO-E, ANSYS	-	HOD	60hrs	Rony Scaria *international trainer*	Students with mechanical Engineering back ground
Project proposal contest	ISTE	HOD	One semester contest	Mathew J Joseph	B. Tech. students

9.7 New Facility Created (20)

Specify new facilities created during the last three years for strengthening the curriculum and/or meeting the PO s.

Various new facilities which has been hitherto unavailable to the students have been created for strengthening the curriculum and/or meeting the P.O's. The important ones have been listed below

- *Industrial visits*

  Industrial visits give the students a firsthand understanding of how big industries work. Industrial visit is mandatory for all students of the department at least once in a year

- *Industrial training*

Students are encouraged to undergo industrial training during their semester break in some industry of their choice. Also a report has to be submitted at the end of industrial training. Industrial training provides an insight to students about what is happening in the real world and also supplements their class room knowledge

- *Software training programmes*

The advent of various software has made life of an engineer easy. So it is essential that students are taught the nuances of various software which would help them in giving better shape to their ideas as also give them an added advantage in their career prospects. With this in mind the department has taken a lead in teaching students soft wares like C, AUTO CAD, PRO -E ANSYS ABAQUS etc.

- *Workshops*

Different workshops related with curriculum are arranged during academic year to enhance their knowledge in engineering subjects and also students are encouraged to participate in workshops conducted by other colleges

- *Participation in paper presentations and technical competitions at the national and international level*

Students are encouraged to participate in paper presentations and technical competitions at national and international levels.

- *Projects (in three levels):*

Students have to carry out a project at micro level (second year) where they chose their area of interest. Micro project mainly aims at familiarizing students with literature review and introduction to apply their class room knowledge to research. Mini level projects (third year project) aims at exposing students to real world scenarios of the theory they have studied in class in their area of interest. Main level (final year) project aims at training them to find solutions to real world problems with their technical knowhow. The development of students from micro to mini to main project has been found to be very effective in their growth as engineers.

- *E- Learning: online Courses*

Students are encouraged to use online materials of their courses and also to attend additional online courses to gain knowledge and experience beyond their curriculum

- *Aptitude training*

Graduate Aptitude Training is given to students during their 3rd and 4th year in order to make them capable of attending all the competitive exams, interviews conducted by industries etc.

9.8 Overall Improvement since last accreditation, if any, otherwise, since the commencement of the programme (20)

Specify the overall improvement:

Specify the strengths/ weakness	Improvement brought in	Contributed by	List the PO(s), which are strengthened
W1. Insufficient number of in-situ project and lack of hands-on working experience	1. Surface Grinder, Autocollimator, Tool Makers Microscope, Profile Projector were procured for the augmentation of machine tool laboratory and mechanical measurement laboratory	Manager	3, 4, 7
W2. Outdated knowledge in the field of recent trends of research and development.	2. Seminars, Workshops, Invited talk, were arranged for the student under auspices of professional societies like IE, AME, and ISTE.	Principal &HOD	1, 3
W3. Department was not able to fully utilize the inter-disciplinary talents of the students and foster their innovative thinking .	3. Micro, Mini level projects are introduced in 2nd year and 3rd year students to enhance the attitude of students towards research and inter-disciplinary knowledge.	Principal &HOD	1, 2, 8
W4. Industrial competence and employability quotient was insufficient	4. Hands-on training and certificate courses on industry par packages like ABAQUS, CATIA, and AutoCAD by international trainers.	Rony Scaria *international trainer*	3, 4, 10
W5. A gap was noticed between market requirement and the theoretical knowledge of the student	5. “Kisan Jyothi”- Agricultural Project exhibition by Department of Mechanical Engineering at Parathode and Kalaketty Open Market.	Students and Staff	1, 9
S1. In collaboration/Request with various governmental organizations student team mentored by staff have developed solutions for socially relevant problems.	6. Ingenious projects like Patient transfer board, Bore well rescue robots, Pepper Separator, Cardamom Dryer etc.	Students and Staff	9, 10

S2. Systematic remedial classes were arranged	7. University results of core subject like Design of transmission elements, Design of Machine elements, Mechanics of Machines etc. were improved	Staff	1,2
S3. Qualified faculty and lab staff	8. Improvised Pedagogy	Faculty and Staff	1, 2, 8
S4. Globally competent project that need monetary backup have been executed by the department using various national funding agency	9.E- CAP for nuclear applications- BRNS, Bore well Rescue Robot- DST, Automatic rice noodle maker with continuous feed -KSCSTE, Table Top Power operated Coconut Husking Machine- DST	Faculty and Staff	9, 10

Declaration

(The Head of the institution needs to make a declaration as per the format given below :)

This Self-Assessment Report (SAR) is prepared for the current academic year (2014-2015) and the current financial year (2014-2015) on behalf of the institution.

I certify that the information provided in this SAR is extracted from the records, and to the best of my knowledge, is correct and complete.

I understand that any false statement/information of consequence may lead to rejection of the application for the accreditation for a period of two or more years. I also understand that the National Board of Accreditation (NBA) or its sub-committees will have the right to decide on the basis of the submitted SAR whether the institution should be considered for an accreditation visit.

If the information provided in the SAR is found to be wrong during the visit or subsequent to grant of accreditation, the NBA has the right to withdraw the grant of accreditation and no accreditation will be allowed for a period of next two years or more, and the fee will be forfeited.

I undertake that the institution shall co-operate the visiting accreditation team, shall provide all desired information during the visit and arrange for the meeting as required for accreditation as per the NBA's provision.

I undertake that, the institution is well aware about the provisions in the NBA's accreditation manual concerned for this application, rules, regulations and notifications in force as on date and the institute shall fully abide to them

Place: Kanjirappally, Kottayam
Date: 15/09/2015

Signature, Name, and Designation of the
Head of the Institution with seal

APPENDIX-1

Syllabus from S1 to S8

EN010 101 ENGINEERING MATHEMATICS – I

Teaching Scheme **Credits: 5**

2 hour lecture and 1 hour tutorial per week

Objectives

- *To impart mathematical background for studying engineering subjects.*

MODULE I (18 hours) - MATRIX

Elementary transformation – echelon form – rank using elementary transformation by reducing in to echelon form – solution of linear homogeneous and non – homogeneous equations using elementary transformation. Linear dependence and independence of vectors – eigen values and eigen vectors – properties of eigen values and eigen vectors(proof not expected) – Linear transformation – Orthogonal transformation – Diagonalisation – Reduction of quadratic form into sum of squares using orthogonal transformation – Rank, index, signature of quadratic form – nature of quadratic form

MODULE 2 (18 hours) - PARTIAL DIFFERENTIATION

Partial differentiation : chain rules – statement of Eulers theorem for homogeneous functions – Jacobian –Application of Taylors series for function of two variables – maxima and minima of function of two variables (proof of results not expected)

MODULE 3 (18 hours) - MULTIPLE INTEGRALS

Double integrals in cartesian and polar co-ordinates – change of order of integration- area using double integrals – change of variables using Jacobian – triple integrals in cartesian, cylindrical and spherical co-ordinates – volume using triple integrals – change of variables using Jacobian – simple problems.

MODULE 4 (18 hours) - ORDINARY DIFFERENTIAL EQUATIONS

Linear differential equation with constant coefficients- complimentary function and particular integral – Finding particular integral using method of variation of parameters – Euler Cauchy equations- Legenders equations

MODULE 5 (18 hours) - LAPLACE TRANSFORMS

Laplace Transforms – shifting theorem –differentiation and integration of transform – Laplace transforms of derivatives and integrals – inverse transform – application of convolution property – Laplace transform of unit step function – second shifting theorem(proof not expected) – Laplace transform of unit impulse function and periodic function – solution of linear differential equation with constant coefficients using Laplace Transform.

REFERENCES

1. Erwin Kreyszig ;Advanced Engineering Mathematics Wiley Eastern Ltd
2. Grewal B.S ;Higher Engineering Mathematics ,Khanna Publishers
3. N. P. Bali ;Engineering Mathematics ,Laxmi Publications Ltd
4. Goyal & Gupta ; Laplace and Fourier Transforms
5. Dr. M.K.Venkataraman ;Engineering Mathematics Vol. I,National Publishing Co.
6. Dr. M.K.Venkataraman Engineering Mathematics Vol. 2, National Publishing Co
7. T.Veerarajan ,Engineering Mathematics for first year, Mc Graw Hill
8. S.S.Sastry Engineering Mathematics Vol. I,Prentice Hall India
9. S.S.Sastry Engineering Mathematics Vol. 2, Prentice Hall India
10. B.V. Ramana Higher Engineering Mathematics, Mc Graw Hill

EN010 102 ENGINEERING PHYSICS

Teaching Scheme **Credits: 4**

I hour lecture and 1 hour tutorial per week

Objectives

- *To provide students knowledge of physics of a problem and an overview of physical phenomena.*

MODULE I (12 hours) LASERS AND HOLOGRAPHY

Lasers- Principle of laser- Absorption- Spontaneous emission- Stimulated emission- Characteristics of laser - Population inversion- Metastable states- Pumping- Pumping Methods- Pumping Schemes- 3 level and 4 level pumping- Optical resonator- Components of laser- Typical laser systems like Ruby laser- He-Ne laser- Semiconductor laser- Applications of laser-

Holography- Basic principle -Recording and reconstruction- comparison with ordinary photography-Applications of Hologram

MODULE II (12 hours) NANOTECHNOLOGY AND SUPERCONDUCTIVITY

Introduction to nanoscale science and technology- nanostructures-nanoring, nanorod, nanoparticle, nanoshells- Properties of nanoparticles- optical, electrical, magnetic, mechanical properties and quantum confinement- Classification of nanomaterials- C_{60}, metallic nanocomposites and polymer nanocomposites- Applications of nanotechnology

B. Superconductivity- Introduction- Properties of super conductors- Zero electrical resistance- Critical temperature- Critical current- Critical magnetic field- Meissner effect- Isotope effect- Persistence of current- Flux quantization - Type I and Type II superconductors- BCS Theory (Qualitative study) – Josephson effect- D.C Josephson effect- A.C Joseph son effect- Applications of superconductors.

MODULE III (12 hours) CRYSTALLOGRAPHY AND MODERN ENGINEERING MATERIALS

A. Crystallography – Space lattice- Basis- Unit cell- Unit cell parameters- Crystal systems- Bravais lattices- Three cubic lattices-sc, bcc, and fcc- Number of atoms per unit cell- Co-ordination number- Atomic radius- Packing factor- Relation between density and crystal lattice constants- Lattice planes and Miller indices-Separation between lattice planes in sc- Bragg's law- Bragg's x-ray spectrometer- Crystal structure analysis.

Liquid crystals- Liquid crystals, display systems-merits and demerits- Metallic glasses- Types of metallic glasses (Metal-metalloid glasses, Metal-metal glasses) – Properties of metallic glasses (Structural, electrical, magnetic and chemical properties)

Shape memory alloys- Shape memory effect, pseudo elasticity

.

MODULE IV (12 hours) ULTRASONICS

A. Ultrasonics- Production of ultrasonics- Magnetostriction method – Piezoelectric method- Properties of ultrasonics- Non destructive testing- Applications

B. Spectroscopy- Rayleigh scattering (Qualitative) - Raman effect – Quantum theory of Raman effect- Experimental study of Raman effect and Raman spectrum- Applications of Raman effect

C. Acoustics- Reverberation- Reverbaration time- Absorption of sound- Sabine's formula(no derivation)- Factors affecting acoustics properties

MODULE V (12 hours) FIBRE OPTICS

Principle and propagation of light in optical fibre- Step index (Single Mode and Multi Mode fibre) and graded index fibre- N.A. and acceptance angle—Characteristics of optical fibres (Pulse dispersion, attenuation, V-number, Bandwidth-distance product) –

Applications of optical fibres- Fibre optic communication system (Block diagram)- Optical fibre sensors (any five) – Optical fibre bundle.

REFERENCES

1) A Text book of Engineering Physics – M.N.Avadhanulu and P.G.Kshirsagar S.Chand& Company Ltd.

2) Nanomaterials- A.K.Bandhopadyaya – New Age International Publishers
3) Engineering Physics – A. Marikani
4) Engineering materials –V Rajendran and Marikani-Tata McGraw-Hill Publishing Company Limited
5) Engineering physics- Dr. M Arumugam - Anuradha Agencies
6) Nano ; The Essentials- T. Pradeep
7) Material Science-M Arumugham- Anuradha Agencies
8) Lasers and Non-Linear optics By B.B Laud- New Age International (P) Limited

EN010 103 Engineering Chemistry & Environmental Studies

(Common to all branches)

Teaching scheme **Credits:4**

1hr lecture and 1hr tutorial per week (total 60 hrs)

Objectives

- *To impart a scientific approach and to familiarize the applications of chemistry in the field of technology*
- *To create an awareness about the major environmental issues for a sustainable development.*

Module 1 Electrochemical Energy Systems (13 hrs)

Electrochemical cells - Galvanic cell - Daniel cell – EMF - determination by potentiometric method - Nernst equation – derivation- Single electrode potential-Types of electrodes- Metal/metal ion electrode, Metal/metal sparingly soluble salt electrode, Gas electrode and Oxidation/reduction electrode - Reference electrodes - Standard hydrogen electrode and Calomel electrode - Glass electrode – Determination of pH using these electrodes - Concentration cell – Electrolytic concentration cell without transfer - Derivation of EMF using Nernst equation for concentration cell - Cells and Batteries - Primary and secondary cells - Lead acid accumulator, Ni-Cd cell, Lithium–MnO_2 cell and Rechargeable Lithium ion cell – Polarization – Overvoltage - Decomposition potential - Numerical problems based on Nernst equations and pH determination.

Module 2 Corrosion and Corrosion Control (10 hrs)

Introduction - Types of corrosion – Chemical and Electrochemical corrosion – Chemical corrosion – Oxidation corrosion, By other gases and Liquid metal corrosion – Pilling-Bedworth rule - Electrochemical corrosion – Mechanism - absorption of O_2 and evolution of H_2 - Types of electrochemical corrosion- Galvanic corrosion, Concentration cell corrosion, Differential aeration corrosion, Pitting corrosion, Waterline corrosion and Stress corrosion - Factors influencing the rate of corrosion - Nature of the metal and Nature of the environment - Corrosion control methods – Selection of metal and proper design, Cathodic protection (Sacrificial anodic protection and Impressed current cathodic protection), Modifying the environment, corrosion inhibitors and Protective coating - Metallic coating – Anodic coating and cathodic coating - Hot dipping (Galvanizing and Tinning), Electroplating, Electroless plating, Metal spraying, Metal cladding Cementation- sheradizing - chromizing- calorizing and Vacuum metallization - Non-metallic coating - Anodization

Module 3 Engineering Materials (13 hrs)

High polymers – Introduction - Degree of polymerization – Functionality – Tacticity - Types of polymerization (mechanisms not required) – Addition, Condensation and Copolymerization - Glass transition temperature-(Tg) Definition only, Compounding and moulding of plastics - Compression, Injection, Extrusion, Transfer and Blow moulding.

Fiber Reinforced Plastics - Glass reinforced plastics (GRP) - Manufacturing methods - Hand lay up, Spray up and Filament winding - properties and uses.

Conducting Polymers – Polyacetylene and Polyaniline - Applications (mechanism not required)

Rubber - Natural rubber – Properties – Vulcanization - Synthetic rubber - Preparation, properties and uses of Polyurethane rubber, NBR and Silicone rubber.

Carbon Nanotubes - Single walled (SWCNT) and Multi walled (MWCNT) - Properties and uses.

Module 4 Environmental Pollution (12 hrs)

Pollution - Types of pollution – a brief study of the various types of pollution - Air pollution - Sources and effects of major air pollutants – Gases - Oxides of carbon, nitrogen and sulphur – Hydrocarbons – Particulates -Control of air pollution - Different methods - Water pollution - Sources and effects of major pollutants - Inorganic pollutants- heavy metals cadmium , lead, mercury - Ammonia, Fertilizers and Sediments (silt) - Organic pollutants – Detergents, pesticides, food waste, - Radioactive materials - Thermal pollutants - Control of water pollution - General methods

Eutrophication - Definition and harmful effects

Desalination of water - Reverse osmosis and Electrodialysis

Module 5 Environmental Issues (12 hrs)

An overview of the major environmental issues - Acid rain – Smog - Photochemical smog - Green house effect - Global warming and climate change - Ozone layer depletion – Deforestation - Causes and effects - Wet land depletion – Consequences, Biodiversity – importance and threats, Soil erosion - Causes and effects, Solid waste disposal -Methods of disposal - Composting, Landfill, and Incineration, E-Waste disposal - Methods of disposal – recycle(recovery) and reuse

Renewable energy sources - Solar cells – Importance - Photo voltaic cell - a brief introduction

Bio fuels - Bio diesel and Power alcohol.

Note: This course should be handled and examination scripts should be evaluated by the faculty members of Chemistry

Text Books

1. A text book of Engineering Chemistry - Shashi Chawla, Dhanpat Rai and Co.
2. A text book of Engineering Chemistry - Jain & Jain 15th edition .
3. A text book of Engineering Chemistry – S. S. Dhara.
4. Modern Engineering Chemistry – Dr. Kochu Baby Manjooran. S.

References

1. Chemistry - John E. McMurry and Robert C. Fay, Pearson Education.
2. Polymer science –V. R. Gowariker, New Age International Ltd.
3. A text book of polymer - M. S. Bhatnagar Vol I, II,& III, S. Chand publications.
4. Nano materials – B. Viswanathan, Narosa publications.
5. Nano science & Technology – V. S. Muralidharan and A. Subramania, Ane Books Pvt. Ltd.
6. Nanotechnology - Er. Rakesh Rathi, S. Chand & Company Ltd.
7. Environmental Studies - Benny Joseph (2nd edition), Tata Mc Graw Hill companies.
8. Environmental Chemistry - Dr. B. K. Sharma, Goel publishers.
9. Environmental Chemistry – A. K. De, New age International Ltd.
10. Industrial Chemistry – B. K. Sharma, Goel publishers.
11. Engineering Chemistry – O. G. Palanna, Tata Mc Graw Hill Education Pvt. Ltd.

EN010 104 ENGINEERING MECHANICS

(Common to all branches)

Teaching Scheme **Credits: 6**

3 hour lecture and 1 hour tutorial per week

Objective:

To develop analytical skills to formulate and solve engineering problems.

Module I (23 hrs)

Introduction to Mechanics – Basic Dimensions and Units – Idealization of Mechanics – Rigid Body – Continuum – Point force – Particle – Vector and Scalar quantities.

Principles of Statics – Force Systems – Coplanar, Collinear, Concurrent and Parallel – Free body diagrams – Resolution of forces – Moment of a Force – Varignon's Theorem – Couple – Resolution of a force into force couple system – Conditions of static equilibrium of Rigid bodies – Solutions of problems using scalar approach

Force Systems in Space – Introduction to Vector approach – Elements of Vector algebra – Position vector – Moment of a Force about a Point and Axis – Resultant of Forces – Equilibrium of forces in space using vector approach

Module II (23 hrs)

Principle of Virtual work – Elementary treatment only – application of virtual work in beams, ladders

Centroid of Lines, Areas and Volumes – Pappus Guldinus Theorems

Moment of Inertia of laminas – Transfer theorems – radius of Gyration – problems

Centre of Gravity – Mass moment of Inertia of circular and rectangular plates – solid rectangular prisms – Cylinders – Cones

Module III (23 hrs)

Friction – Laws of friction – Contact friction problems – ladder friction – Wedge friction – Screw friction.

Introduction to Structural Mechanics – Types of Supports, loads, frames – Static Indeterminacy – Support reactions of beams – Analysis of perfect trusses by method of joints, method of sections.

Module IV (28hrs)

Kinematics – Rectilinear motion of a particle under Variable Acceleration

Relative Velocity - problems

Circular motion with Uniform and Variable Acceleration – Relations between Angular and Rectilinear motion – Normal and Tangential accelerations

Combined motion of Rotation and Translation – Instantaneous centre of zero velocity – Wheels rolling without slipping

Introduction to Mechanical Vibrations – Free vibrations – Simple Harmonic motion

Module IV (23 hrs)

Kinetics of particles – Newton's laws of Motion of Translation – D'Alembert's Principle – Motion of connected bodies – Work Energy Principle – Principle of Momentum and Impulse – Collision of Elastic bodies

Newton's laws of Rotational motion – Angular Impulse and Torque – Conservation of Angular Momentum – Centrifugal and Centripetal forces – Applications – Work done and Power by Torque and Couple.

References:

1. Engineering Mechanics – S. Timoshenko, D.H. Young & J. V. Rao – Tata Mc Graw Hill
2. Engineering Mechanics – Statics and Dynamics – Irving H Shames, G Krishna Mohana Rao – Pearson Edutcation
3. S. Rajasekararn & G.Sankarasubramanian, Engineering Mechanics, Vikas Publishing Co.
4. Engineering Mechanics – Prof.J.Benjamin, Pentex Publishers
5. Engineering Mechanics – G. S. Sawhney PHI Learning Private Ltd. New Delhi
6. Engineering Mechanics – K. L. Kumar, Tata Mc Graw Hill, New Delhi

EN010 105: ENGINEERING GRAPHICS

Teaching Scheme **Credits: 6**

I hour lecture and 3 hour drawing per week

Objectives

- *To provide students of all branches of engineering with fundamental knoeledge of engineering drawing*
- *To impart drawing skills to students*

MODULE 1 (24 hours)

Introduction to Engineering Graphics: Drawing instruments and their uses-familiarization with current BIS code of practice for general engineering drawing.

Scales-Plain scales-Diagonal Scales-Forward and Backward Vernier Scales.

Conic Sections:-Construction of conics when eccentricity and distance from directrix are given .Construction of ellipse (1) given major axis and foci (2) given major axis and minor axis (3)given a pair of conjugate diameters (4) by the four centre method. Construction of parabola given the axis and base. Construction of hyperbola-(1) given the asymptotes and a point on the curve. (2) Given ordinate, abscissa and transverse axis. Construction of rectangular hyperbola. Construction of tangents and normals at points on these curves.

Miscellaneous curves:-Cycloids, Inferior and superior Trochoids-Epicycloid-Hypocycloid-Involute of circle and plain figures-Archimedian Spiral and Logarithmic Spiral- Tangents and normals at points on these curves.

MODULE 2 (24 hours)

Orthographic projections of points and lines:-Projections of points in different quadrants-Projections of straight lines parallel to one plane and inclined to the other plane-straight lines inclined to both the planes-true length and inclination of lines with reference planes using line rotation and plane rotation methods –Traces of lines.

Orthographic projections of planes-Polygonal surfaces and circular lamina.

MODULE 3 (24 hours)

Orthographic projections of solids:-Projections of prisms , cones ,cylinders ,pyramids ,tetrahedron, octahedron and spheres with axis parallel to one plane and parallel or perpendicular to the other plane-the above solids with their axes parallel to one plane and inclined to the other plane –axis inclined to both the reference planes-use change of position method OR auxiliary method.

Sections of solids:-Sections of prisms ,cones , cylinders ,pyramids ,tetrahedron and octahedron with axis parallel to one plane and parallel or perpendicular or inclined to the other plane with section planes perpendicular to one plane and parallel , perpendicular or inclined to the other plane –True shapes of sections.

MODULE 4 (24 hours)

Developments of surfaces of (1)simple solids like prisms ,pyramids , cylinder and cone (2) sectioned regular solids (3)above solids with circular or square holes with their axes intersecting at right angles.-Developments of funnels and pipe elbows.

Isometric Projections:-Isometric Scales-Isometric views and projections of plane figures, simple & truncated solids such as prisms, pyramids, cylinder, cone, sphere, hemisphere and their combinations with axis parallel to one the planes and parallel or perpendicular to the other plane.

MODULE 5 (24 hours)

Perspective projections:-Perspective projections of prisms, pyramids, cylinder and cone with axis parallel to one plane and parallel or perpendicular or inclined to the other plane by visual ray method OR vanishing point method

Intersection of surfaces:-Intersection of prism in prism &cylinder in cylinder-Axis at right angles only.

REFERENCES

1. Engineering Graphics-Unique Methods easy solutions-K.N Anilkumar
2. Engineering Graphics-P I Varghese.
3. Engineering Drawing-N D Bhatt
4. Engineering Graphics-P S Gill
5. Engineering Graphics-T S Jeyapoovan.

EN010 106: BASIC CIVIL ENGINEERING

(Common to all branches)

Teaching scheme: **Credits: 4**

1 hour lecture and 1 hour tutorial per week

Objective:

To familiarize all engineering students with the basic concepts of civil engineering so that they can perform better in this great profession "Engineering".

Module 1 (12 hours)

Introduction to civil engineering : various fields of civil engineering- Engineering materials: Cement – Bogues compounds, manufacture of Portland cement-wet and dry process, grades of cement, types of cement and its uses – steel– types of steel for reinforcement bars ,structural steel sections,built-up sections,light gauge sections. Aggregates: Fine aggregate:- pitsand, riversand, M- sand--Coarse aggregate: natural and artificial , requirements of good aggregates. Timber: varieties found in Kerala – seasoning and preservation. Bricks**:** classification, requirements, tests on bricks.

Module 2 (12 hours)

Cement mortar- preparation and its uses– concrete –ingredients, grades of concrete – water cement ratio, workability, curing, ready mix concrete. Roofs - roofing materials -A. C, aluminium, GI, fibre, tile, reinforced concrete (brief description only)- reinforcement details of a one way slab, two way slab and simply supported beams.

Module 3 (12 hours)

Building Components: Foundation: Bearing capacity and settlement - definitions only-footings-isolated footing , combined footing - rafts, piles and well foundation , machine foundation (Brief description only).

Superstructure: Walls - brick masonry – types of bonds , English bond for one brick -stone masonry-Random Rubble masonry.

Module 4 (12 hours)

Surveying**:** Classification –principles of surveying- chain triangulation- instruments used, field work – bearing of survey lines –WCB and reduced bearing -Leveling: field work - reduction of levels - height of instrument method.

Introduction to total station- basic principles of remote sensing, GPS and GIS.

Module 5 (12 hours)

Site plan preparation for buildings (Sketch only) – Kerala Municipal Building Rules (1999)-general provisions regarding site and building requirements – coverage and floor area ratio – basic concepts of "intelligent buildings" and "green buildings"- disposal of domestic waste water through septic tank and soak pit. Classification of roads- basics of traffic engineering – road markings , signs, signals and islands, road safety-accidents, causes and remedies– (brief description only)

References

1. Jha and Sinha, Construction and foundation Engineering, Khanna Publishers
2. Punmia B. C., Surveying Vol –I, Laxmi Publications
3. Rangwala, Building Materials, Charotar Book stall
4. K. Khanna ,C. E. G. Justo., Highway Engineering, Khanna Publishers
5. Nevile., Properties of Concrete, Mc Graw Hill
6. B C Punmia.,Basic Civil Engineering, Khanna Publishers
7. Kerala Municipal Building Rules – 1999

EN010 107 BASIC MECHANICAL ENGINEERING

(Common to all branches)

Teaching scheme **Credits- 4**

1hour lecture and1hour tutorial per week

Objective

To impart basic knowledge in mechanical engineering

Module 1(12 hours)

Thermodynamics: Basic concepts and definitions, Gas laws, specific heat –Universal gas constant- Isothermal, adiabatic and polytrophic processes, work done, heat transferred, internal energy and entropy - Cycles: Carnot, Otto and Diesel- Air standard efficiency.

Basic laws of heat transfer (Fourier's law of heat conduction, Newton's law of cooling Steffen Boltzmann's law)

Module 2 (12 hours)

I.C. Engines: Classification of I.C Engines, Different parts of I.C engines, Working of two stroke and four stroke engines-petrol and diesel engines-air intake system, exhaust system, fuel supply system, ignition system, lubrication system, cooling system and engine starting system-Performance of I.C. engines, advantage of MPFI and CRDI over conventional system.

Refrigeration: Unit of refrigeration, COP, Block diagram and general descriptions of air refrigeration system, vapour compression and vapour absorption systems- Required properties of a refrigerant, important refrigerants– Domestic refrigerator- Ice plant.

Air conditioning system: Concept of Air conditioning, psychometry, psychometric properties, psychometric chart, psychometric processes, human comfort– winter and summer air conditioning systems (general description), air conditioning application.

Module 3 (12 hours)

Power transmission elements: Belt Drive **-** velocity ratio of belt drive, length of belt, slip in belt- simple problems– Power transmitted– Ratio of tensions– Centrifugal tension Initial tension– Rope drive, chain drive and gear drive-Types of gear trains (simple description only).

Module 4 (12 hours)

Power plants: General layout of hydraulic, diesel, thermal and nuclear power plants-nonconventional energy sources (general description only).

Hydraulic turbines and pumps : Classifications of hydraulic turbines –types of hydraulic turbines – runaway speed, specific speed, draft tube, cavitations, selection of hydraulic turbines .Classification of pumps– positive displacement and rotodynamic pumps (description only)- applications

Steam turbines: Classification of steam turbines, description of common types of steam turbines: Impulse and reaction, compounding methods.

Module 5 (12 hours)

Simple description of general purpose machines like lathe, shaping machines, drilling machines, grinding machines and milling machines, Basic concepts of CNC, DNC, CIM and CAD/CAM

Manufacturing Processes: Moulding and casting, forging, rolling, welding- arc welding-gas welding (fundamentals and simple descriptions only)

Text book

1 P.L. Bellany, *Thermal Engineering,* Khanna Publishes

2 Benjamin J., *Basic Mechanical Engineering,* Pentex

Reference Books

1 R.C.Patel, *Elements of heat engines*, Acharya Publishers -

2 G.R Nagapal, *Power plant engineering,* Khnna publishes

3 P.K.Nag, *Engineering Thermodynamics,* McGraw Hill

4 Dr.P.R Modi &Dr.M.S. Seth, *Hydraulics & Fluid Mechanics including Hydraulic Machines,* Standard Book House

EN010 108: Basic Electrical Engineering

(Common to all branches)

Teaching Scheme
Credits: 4
I hour lecture and 1 hour tutorial per week

Objectives

- *To provide students of all branches of engineering with an overview of all the fields of electrical engineering*
- *To prepare students for learning advanced topics in electrical engineering*

Module I (10 hours)
Kirchhoff's Laws – Formation of network equations by mesh current method – Matrix representation – Solution of network equations by matrix method – Star delta conversion.
Magnetic circuits – mmf, field strength, flux density, reluctance, permeability – comparison of electric and magnetic circuits – force on current carrying conductor in magnetic filed.

Module II (12 hours)
Electromagnetic Induction – Faraday's laws – lenz's law – statically and dynamically induced emf – self and mutual inductance – coupling coefficient.
Alternating current fundamentals – generation of AC –frequency, period, average and r m s value, form factor, peak factor, phasor representation – j operator – power and power factor – solution of RLC series and parallel circuits.

Module III (13 hours)
DC machine – principle of operation of DC generator – constructional details – e m f equation – types of generators.
DC motor – principle of operation of DC motor – back emf – need for starter – losses and efficiency – types of motors – applications – simple problems.
Transformer – principle of operation – e m f equation Constructional details of single phase and three phase transformer – losses and efficiency – application of power transformer, distribution transformer, current transformer and potential transformer.

Module IV (13 hours)
Three phase system – generation of three phase voltage – star and delta system – relation between line and phase voltages and currents – phasor representation of three phase system - balanced delta connected system – three wire and four wire system – simple problems. Three phase power measurement – Single wattmeter, two wattmeter and three wattmeter methods.
Induction motors – principle of operation of three phase induction motors – applications of cage and slip ring induction motor – single phase induction motors – capacitor start / run, shaded pole – universal motors - Applications.
Synchronous generator (Alternator) – principles of operation and types.

Module V (12 hours)
Generation of electric power – types of generation – hydroelectric, thermal and nuclear (Block schematic and layout only) - Non conventional energy sources – solar, wind, tidal, wave and geothermal.

Transmission – need for high voltage transmission – Transmission voltage – Distribution – Underground versus overhead – Feeder – Distributor – Service mains – conductor materials – one line diagram of typical power system.
Requirements of good lighting system – working principle of incandescent lamp, Fluorescent lamp and mercury vapour lamp-energy efficient lamps (CFL,LED lights) – need for energy management and power quality – home energy management.

Text Books

1. D.P. Kothari & I.J. Nagrath – Basic Electrical Engineering – Tata McGraw Hill
2. D.C. Kulshreshta – Basic Electrical Engineering - Tata McGraw Hill
3. Hughes – Electrical and Electronic Technology – Pearson Education

Reference Books

1. R.V. Srinivasa Murthy – Basic Electrical Engineering – Sunguine Technical
2. J.B.Gupta – Fundamentals of Electrical Engineering & Electronics – S.K.Kataria
3. V.K. Mehta, Rohit Mehta – Basic Electrical Engineering – S.Chand.
4. Bureau of Engineering Efficiency – Guide book for national certification examination for energy managers and auditors.
5. Rajendra Prasad – Fundamentals of Electrical Engineering, Prentice Hall India.
6. Soni, Gupta, Bhatnagar & Chackrabarty – A text book on power system engineering – Dhanapt Rai
7. Electrical Engineering Fundamentals – Vincent Del Toro, Pearson Education.

EN010 109: Basic Electronics Engineering and Information Technology

(Common to all branches)

Teaching Scheme **Credits: 5**

2 hour lecture and 1 hour tutorial per week

Objectives

- *To provide students of all branches of engineering with an overview of all the fields of electronics engineering and information technology*

MODULE 1 (18 hours): Basic Circuit Components: *Diode:* Germanium, Silicon, Zener, LEDs (working principle only). Forward and reverse characteristics. [2hr.] *Rectifiers*: Half wave, fullwave , Bridge circuits, DC Power supply: Capacitor filter, Zener regulator. [3hrs.] *Transistors* :Different configurations - CE characteristics-β and □$\propto$, concept of Amplifiers: □ Common emitter RC coupled amplifier, Frequency response, Bandwidth.(No analysis required) Comparison of BJT,FET,MOSFET, IGBT. [2hr.]. *Integrated circuits*: Advantages, classification of Linear and Digital ICs. Basics of Op-amps, inverting and non-inverting amplifiers.Family of IC's(Function diagram of 7400 & CD4011) [4hrs.] .Specifications of TTL and CMOS.[] –Comparison.

MODULE 2 (18 hours): Basic communication Engineering:*Communication:* Frequency bands: RF, VHF, UHF, x, ku, ka, c. Modulation – need for modulation, basic principles of amplitude, frequency and pulse modulation. [6hrs.]. Block schematic of AM transmitter , Super-hetrodyne receiver, FM receiver.-function of each block.[3hrs.] .*Wireless communication*: *Satellite Communication*-Earth station, transponder and receiver.*Mobile Communication*: GSM-BSC, Cell structure, frequency re-use, hands-of, establishing a call.

MODULE 3 (18 hours):Basic instrumentation and Consumer electronics: *Electronic instrumentation*: Transducers: Basic principles of Strain guage, LVDT, Thermistor, Photodiode, Typical moving coil microphones and Loud speaker.Block diagram of Digital Multimeter .[8hrs*]*.*CONSUMER ELECTRONICS*: Basic principles of TV –Interlaced Scanning-Block Diagram of PAL TV receiver(color).Basic principles of DTH, brief descriptions of MP3,multichannel audio 5.1,7.1.

MODULE 4 (18 hours):**Introduction**: Definition and Scope of IT-Digital Computer, Von Neumann Architecture-Basic Operational Concepts-CPU-single Bus and Multi Bus Organization, A typical Instruction set, Execution of Instructions. **Memory and I/O**-Main Memory, Virtual Memory-Cache memory-Secondary Memories-Printers, Plotters, Displays ,Key board, Mouse, OMR and OCR-Device Interface-I/O Processor-I/O Channel

MODULE 5 (18 hours) :Computer software-System Software and Application Software-Machine Language-Assembly Language-High Level Language-Language Translators-Operating System, Procedural Programming and Object Oriented Programming.**Computer Networks-**Concepts of Networking-Network Topologies-WAN-LAN-MAN, Protocol-Internet-working concept, Internet Architecture, IP addresses, Routing, Domain Name System(Basic concepts only)

References

1.Basic Electronics – Devices, Circuits and IT fundamentals.Santiram Kal,PHI(Module 1to 5)
2. Basic Electronics: Bernad Grob, Mc Graw Hill Publication(Module 1)
3. Electronic Devices: Floyd, Pearson Education (Module 1)
4. Electronic Devices and Circuits: J.B. Gupta,S.K.Kataria & Sons (Module 1 , 2,3)
5. Digital Principles: Malvino & Leach, Mc Graw Hill Publication(Module 1)
6. Electronic Instrumentation: H.S Kalsi, Mc Graw Hill Publication(Module 2)
7. Communication Systems: Sanjay Sharma, S.K.Kataria & Sons (Module 2)
8. Satellite Comunication : Robert M.Gagliardi,CBS Publishers & Distributors.(Module 2)
9.Basic Radio and TV; S.P. Sharma,Tata McGrawhill(Module 2 &3)
10.Wireless Communication; T.S. Rappaport, Pearson(Module 3)
11.Computer Organization, Hamacher, Vranesic and Zaky, Mc Graw Hill (Module 4)
12.Systems Programming, JJ Donovan ,Mc Graw Hill (Module 5)
13.Computer Networks,Andrew.S Tanenbaum,Pearson Education(Module 5)

EN010 110: Mechanical Workshop

(Common to all branches)

Teaching scheme **Credits: 1**

3 hours practical per week

Objectives

- *To provide students of all branches of engineering in house experience of basic mechanical instruments and activities*

Carpentry Planing – cutting – chiselling, marking – sawing – cross and tee joints – dovetail joints – engineering application, Seasoning, Preservation – Plywood and ply boards.

Fitting Practice in chipping – filing – cutting – male and female joints.

Smithy Forging of square and hexagonal prism. Study of forging principles, materials and operations.

Foundry Preparation of simple sand moulds – moulding sand characteristics, materials, gate, runner, riser, core, chaplets and casting defects.

Demonstration and study of machine tools – lathe, drilling, boring, slotting, shaping, milling and grinding machines, CNC machines and machining centers.

Demonstration and study of arc and gas welding techniques.

EN010 111: Electrical and Civil Workshops

(Common to all branches)

Teaching scheme **Credits: 1**

3 hours practical per 2 weeks for each

Objectives

- *To provide students of all branches of engineering in house experience of basic electrical and civil instruments and activities*

Electrical Workshop

1. Wiring and estimation of one lamp and one plug, Control of two lamps in series and in parallel.
2. Staircase wiring.
3. Godown wiring.
4. Insulation megger - earth megger , measurement of insulation resistance and earth resistance .Study of volt meter, ammeter , watt meter and energy meter.
5. Working principle and wiring of Fluorescent , CFL and Mercury vapour lamp .
6. Study and wiring of distribution board including power plug using isolator, MCB and ELCB – Estimation of a typical 1BHK house wiring system.
7. Familiarization , soldering, testing and observing the wave forms on a CRO of a HW and FW Uncontrolled Rectifier (using diodes) with capacitor filter.
8. Observing the wave forms on a CRO of Experiment 7 without capacitor filter and find the average and RMS value of the voltage waveform.
9. Visit your college substation and familiarize the supply system, Transformer, HT Panel and Distribution etc.

Civil Workshop

Masonry : English bond – Flemish bond – wall junction – one brick – one and a half brick – two brick and two and a half brick – Arch setting.

Plumbing: Study of water supply and sanitary fittings – water supply pipe fitting – tap connections – sanitary fittings – urinal, wash basin – closet (European and Indian), Manholes.

Surveying: Study of surveying instruments – chain – compass – plane table – levelling – minor instruments. Demonstration of Theodolite and Total Station.

Familiarization of latest building materials : Flooring materials – Roofing materials – Paneling boards.

EN010301A ENGINEERING MATHEMATICS II

(Common to all branches except CS & IT)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives

- *To apply standard methods and basic numerical techniques for solving problems and to know the importance of learning theories in Mathematics.*

MODULE 1 Vector differential calculus (12 hours)

Scalar and vector fields – gradient-physical meaning- directional derivative-divergence an curl - physical meaning-scalar potential conservative field- identities - simple problems

MODULE 2 Vector integral calculus (12 hours)

Line integral - work done by a force along a path-surface and volume integral-application of Greens theorem, Stokes theorem and Gauss divergence theorem

MODULE 3 Finite differences (12 hours)

Finite difference operators Δ, ∇, E, μ and δ - interpolation using Newtons forward and backward formula – problems using Stirlings formula, Lagrange's formula and Newton's divided difference formula

MODULE 4 Difference Calculus (12 hours)

Numerical differentiation using Newtons forward and backward formula – Numerical integration – Newton's – cotes formula – Trapezoidal rule – Simpsons $1/3^{rd}$ and $3/8^{th}$ rule – Difference equations – solution of difference equation

MODULE 5 **Z** transforms (12 hours)

Definition of Z transforms – transform of polynomial function and trignometric functions – shifting property , convolution property - inverse transformation – solution of 1^{st} and 2^{nd} order difference equations with constant coifficients using Z transforms.

Reference

1. Erwin Kreyszing – Advance Engg. Mathematics – Wiley Eastern Ltd.
2. B.S. Grewal – Higher Engg. Mathematics - Khanna Publishers
3. B.V. Ramana - Higher Engg. Mathematics – McGraw Hill
4. K Venkataraman- Numerical methods in science and Engg -National publishing co
5. S.S Sastry - Introductory methods of Numerical Analysis -PHI
6. T.Veerarajan and T.Ramachandran- Numerical Methods- McGraw Hill
7. Babu Ram – Engg. Mathematics -Pearson.
8. H.C.Taneja Advanced Engg. Mathematics Vol I – I.K.International

EN010 302 Economics and Communication Skills

(Common to all branches)

Teaching scheme
2hours lecture and 2 hours tutorial per week **Credits: 4(3+1)**
Objectives

- To impart a sound knowledge of the fundamentals of Economics.

Economics

Module I (7 hours)
Reserve Bank of India-functions-credit control-quantitative and qualitative techniques
Commercial banks-functions- Role of Small Industries Development Bank of India and National Bank for Agriculture and Rural Development
The stock market-functions-problems faced by the stock market in India-mutual funds

Module II (6 hours)
Multinational corporations in India-impact of MNC's in the Indian economy
Globalisation-necessity-consequences
Privatisation-reasons-disinvestment of public sector undertakings
The information technology industry in India-future prospects
Module III (6 hours)
Direct and indirect taxes- impact and incidence- merits of direct and indirect taxes-progressive and regressive taxes-canons of taxation-functions of tax system-
tax evasion-reasons for tax evasion in India-consequences-steps to control tax evasion
Deficit financing-role-problems associated with deficit financing

Module IV (5 hours)
National income-concepts-GNP, NNP, NI, PI and DPI-methods of estimating national income-difficulties in estimating national income
Inflation-demand pull and cost push-effects of inflation-government measures to control inflation

Module V (6 hours)
International trade-case for free trade-case for protectionism
Balance of payments-causes of disequilibrium in India's BOP-General Agreement on Tariffs and Trade-effect of TRIPS and TRIMS in the Indian economy-impact of WTO decisions on Indian industry

Text Books

1. Ruddar Datt, Indian Economy, S.Chand and Company Ltd.
2. K.K.Dewett, Modern Economic Theory, S.Chand and Company Ltd.

References

1. Paul Samuelson, Economics, Tata McGraw Hill
2. Terence Byres, The Indian Economy, Oxford University Press
3. S.K.Ray, The Indian economy, Prentice Hall of India
4. Campbell McConnel, Economics, Tata McGraw Hill

Communication Skills

Objectives

- To improve Language Proficiency of the Engineering students
- To enable them to express themselves fluently and appropriately in social and professional contexts
- To equip them with the components of different forms of writing

MODULE – 1 (15 hours)

INTRODUCTION TO COMMUNICATION

Communication nature and process, Types of communication - Verbal and Non verbal, Communication Flow-Upward, Downward and Horizontal, Importance of communication skills in society, Listening skills, Reading comprehension, Presentation Techniques, Group Discussion, Interview skills, Soft skills

MODULE – II (15 hours)

TECHNICAL COMMUNICATION

Technical writing skills- Vocabulary enhancement-synonyms, Word Formation-suffix, affix, prefix, Business letters, Emails, Job Application, Curriculum Vitae, Report writing-Types of reports

Note: No university examination for communication skills. There will be internal evaluation for 1 credit.

REFERENCES

1. The functional aspects of communication skills, P.Prasad and Rajendra K. Sharma, S.K. Kataria and sons, 2007
2. Communication skills for Engineers and Scientists, Sangeeta Sharma and Binod Mishra, PHI Learning private limited, 2010
3. Professional Communication, Kumkum Bhardwaj, I.K. International (P) House limited, 2008
4. English for technical Communication, Aysha Viswamohan, Tata Mc Graw Publishing company limited, 2008

ME010 303: Fluid Mechanics
(Common with AN010 303 & PE010 303)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of fluid mechanics by providing exposure to diverse real world engineering examples.*
- *To develop understanding about basic laws and equations used for analysis of static and dynamic fluids.*

Module I (15 hours)
Introduction and basic concepts-properties of fluids-density, specific gravity, specific weight, specific volume, capillarity, surface tension, compressibility, bulk modulus, viscosity-Newtonian and non Newtonian fluids.
Fluid statics: pressure-variation of pressure-absolute and guage pressure- Pascal's law, manometers- hydrostatic force on plane and curved surfaces-buoyancy and floatation-stability of submerged and floating bodies-metacentric height.
Module II (12 hours)
Euler's momentum equation-Bernoulli's equation and its limitations-momentum and energy correction factors-applications of Bernoulli's equation-venturimeter, orifice meter, pitot tube, orifices and mouthpieces, notches and weirs-rotameter.

Module III (10 hours)
Flow through pipes-laminar and turbulent flow in pipes-critical Reylond's number- Darcy Weisbach equation-hydraulic radius-power transmission through pipes-losses in pipes-pipes in series pipes in parallel-hydraulic gradient line and total energy line-equivalent pipe--moody's diagram-water hammer.
Open channel flow-Chezy's equation-most economical cross section-hydraulic jump.
Module IV (12 hours)
Fluid kinematics-Eulerian and Lagrangian approaches-classification of fluid flow-graphical description of flow pattern-stream lines, path lines, streak lines, stream tubes-velocity and acceleration in fluid flow-continuity equation.
Ideal fluids-rotational and irrotational flow-circulation and vorticity-potential function and stream function, basic flow fields-uniform flow. Source, sink, doublet, vortex, spiral flow, flow past a cylinder with circulation-Magnus effect-Joukowski theorem.

Module V (11 hours)
Boundary layer-boundary layer flow theory- boundary layer over flat plate- boundary layer thickness-displacement, momentum and energy thickness-boundary layer separation-methods of controlling-wake-drag force on a rectangular plate-pressure drag-friction drag-total drag-streamlined body-bluff body, lift and drag force on an aerofoil-characteristics-work done. Hagen-Poiseuille equation.

Text Books

1. Yunus A. Cengel and John M. Cimbala, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
2. R.K.Rajput, *Fluid Mechanics*, S Chand and Company, New Delhi

Reference Books

1. Douglas, *Fluid Mechanics*, Pearson Education, New Delhi
2. Shames I.H, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
3. D. S .Kumar , *Fluid Mechanics*, S. K. Kataria & Sons, New Delhi
4. White F.M, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
5. S. K. Som & G Biswas, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
6. R. K. Bhansal, *Fluid Mechanics& Hydraulic Machines*, Laxmi Publications, New Delhi
7. B.S Massey, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
8. Mody & Seth, *Fluid Mechanics& Hydraulic Machines*, Laxmi Publications, New Delhi
9. F.M. Streeter, *Fluid Mechanics*, Tata McGraw Hill, New Delhi
10. Jagdishlal , *Fluid Mechanics & Hydraulics*, Metropolitan Book Co., New Delhi

ME010 304: Metallurgy and Material Science

(Common with PE010 304 and AU010 304)

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide physical concepts of atomic radius, atomic structure, chemical bonds, crystal structure, grain size, work hardening,, heat treatment etc. of metals with mechanical behaviour.*
- *To understand the causes of metal failure and deformation*
- *To determine properties of unknown materials and develop an awareness to apply this knowledge in material design.*

Module 1 (12 hours)

Atomic structure:- Correlation of atomic radius to strength, electron configurations (basic only) - **Primary bonds**:**-** Covalent and Ionic bond: bond energy with strength, cohesive force, density, directional and non-directional bonding; Metallic bond: conductivity, ductility, opaque, lustrous, density, non directional bonding – **Specific properties of bonding**:**-** Deeper energy well bond and shallow energy well bond, melting temperature, modulus of elasticity, coefficient of thermal expansion and attributes of modulus of elasticity in metal cutting process **- Secondary bonds:-** classification, hydrogen bond, specific heat etc.

Crystallography:- Crystal, space lattice, unit cell - BCC, FCC, HCP structures - short and long range order - Effects of crystalline and amorphous structure on mechanical properties - Determination of atomic packing factor of SC, BCC, FCC, coordination number; densities - Polymorphism and allotropy - **Miller Indices:-** slip system, brittleness of BCC, HCP and ductility of FCC **- Modes of plastic deformation:-** Slip, twinning, Schmid's law, correlation of slip system with slip in metals.

Module 2 (12 hours)

Classification of crystal imperfections: **-** types of **dislocation**, source of dislocation, cross slip, climb, jog, kink, forest of dislocation, role of surface defects on crack initiation - Burgers vector - Correlation of dislocation density with strength and nano concept - Significance of **Frank and Read source** in metals deformation - **Mechanism of crystallization:** Homogeneous and heterogeneous nuclei formation, under cooling, dendritic growth, grain boundary irregularity - Effects of grain size, grain size distribution, grain shape, grain orientation on dislocation/strength and creep resistance - Hall - Petch equation; significance high and low angle grain boundaries on dislocation **-** – polishing and etching to determine the microstructure - crystal structure determination by **X - ray diffraction** method - ***Diffusion*** in solids, fick's laws, mechanisms, applications of diffusion in mechanical engineering.

Module 3 (12 hours)

Phase diagrams: - Limitations of pure metals and need of alloying - classification of alloys, solid solutions, Hume Rothery`s rule - single phase, multi-phase equilibrium diagrams - lever rule and Gibb`s phase rule - Coring - Equilibrium diagrams reactions:- monotectic, eutectic, eutectoid, peritectic, peritectoid - Detailed discussion on **Iron-Carbon equilibrium diagram** with **microstructure** and properties changes in austenite, ledeburite, ferrite, cementite, interlamellar spacing of pearlite to strength etc, special features of martensite transformation, bainite, spheroidite etc..

Heat treatment:- Definition and necessity - TTT diagrams - critical cooling rate (CCT) - annealing, normalizing, hardening, spheroidizing - Tempering:- austermpering, martempering and ausforming - Hardenability, Jominy end quench test, applications – hardness and micro-hardness tests - **surface hardening methods**:- carburizing processes; Nitriding; Flame, induction, laser and electron beam hardening processes; applications **- Types of Strengthening mechanisms:-** grain size reduction, work hardening, Solid solution hardening, precipitation strengthening and over ageing, dispersion hardening **- Cold working**: Detailed discussion on strain hardening; recovery; re-crystallization, effect of stored energy; re-crystallization temperature, effect of grain size; driving force for grain growth - **hot working** - Bauschiner effect and attributes in metal forming.

Module 4 (12 hours)

Alloy steels:- Effects of alloying elements on: dislocation movement, polymorphic transformation temperature, formation and stability of carbides, grain growth, displacement of the eutectoid point, retardation of the transformation rates, improvement in corrosion resistance, mechanical properties – Nickel steels, Chromium steels etc. - Enhancement of **steel properties** by **adding alloying elements:-** Molybdenum, Nickel, Chromium, Vanadium, Tungsten, Cobalt, Silicon, Copper and Lead – **High speed steels:-** Mo and W types, effect of different alloying elements in HSS - **Cast irons**: Classifications, grey, white, malleable and spheroidal graphite cast iron, composition, microstructure, properties and applications – Principal **Non ferrous Alloys:** - Aluminum, Copper, Magnesium, Nickel, Titanium, study of composition, microstructure, properties, applications, reference shall be made to the phase diagrams whenever necessary.

Module 5 (12 hours)

Fracture: – Brittle and ductile fracture - Griffith theory of brittle fracture - stress concentration, stress raiser – Effect of plastic deformation on crack propagation – transgranular, intergranular fracture - Effect of impact loading on ductile material and its application in forging etc.- **Fatigue**:- Stress cycles – Primary and secondary stress raisers - Characteristics of fatigue failure, S-N curve - Factors affecting fatigue strength: stress concentration, size effect, surface roughness, change in surface properties, surface residual stress -Ways to improve fatigue life – effect of temperature on fatigue, thermal fatigue and its applications in metal cutting – Mechanism of fatigue failure – structural features of fatigue:- crack initiation, growth, propagation – fatigue tests - Fracture toughness (definition only) - Ductile to brittle transition temperature **(DBTT)** in steels - **Creep**:- Creep curves – creep tests- Structural change:- deformation by slip, sub-grain formation, grain boundary sliding – Mechanism of creep deformation - threshold for creep - prevention against creep- **Super plasticity:** applications.

Text Books

1. Introduction to Physical Metallurgy – Tata McGraw Hill.
2. Callister William. D. – Material Science and Engineering – John Wiley.
3. Dieter George E. – Mechanical Metallurgy – McGraw Hill.
4. Higgins R.A. – Engineering Metallurgy part - I – ELBS.
5. Raghavan V. - Material Science and Engineering - Prentice Hall.
6. Van Vlack – Elements of Material Science - Addison Wesley.

Reference Books

1. Anderson J.C. *et.al*. – Material Science for Engineers – Chapman and Hall.
2. Clark and Varney - Physical metallurgy for Engineers – Van Nostrand.
3. Manas Chanda - Science to Engineering Materials - Vol I, II and III - Macmillan India.
4. Reed Hill E. Robert – Physical Metallurgy Principles – East West Press.
5. Richards C.W. – Engineering Material Science.

ME010 305: Programming in C
(Common with PE010 305 and AU010 305)

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives
- *To impart advanced knowledge in programming in C language*

Module I (15 hours)
Introduction to computer programming; Various I/O functions; Data types; Constants and Variables; Escape Sequences; Type Casting; Preprocessor Directive; Storage Classes; Scope of Variables; Mathematical Operators; Relational Operators; Branching Instructions; Logical Operators; Conditional Operator; Precedence of Operators; Loops – for, while and do-while, break and continue instructions, Nested Loops; Switch statement; Evaluation of e^x, sin(x), cos(x) Numerical Integration using Trapezoidal and Simpson's rules.

Module II (10 hours)
Arrays; One Dimensional Arrays; Selection Sorting; Binary Searching; Various String Handling Functions; Multidimensional Arrays; Matrix Operations (Addition, Transpose and Multiplication); Sorting of Strings; Structure and Union; Array of Structures;

Module III (10 hours)
Functions; Call by Value Method; Stack; Passing One Dimensional and Multidimensional Arrays to a Function; Recursion; Writing Different String Handling Functions Using Simple Functions and Functions with Recursive Calls; Quick Sorting; Macros; Writing Macros for Simple Operations;

Module IV (15 hours)
Declaration of Pointers; Call by Reference Method; Pointer to a Structure; Pointer to an Array; Array of Pointers; Pointer to a Pointer; Self Referential Structure; Dynamic Memory Allocation; Reallocation of Memory; Linear Linked List; Circular Linked List; Double Linked List; Addition, Insertion and Deletion of Nodes from a Linked List; Command Line Arguments

Module V (10 hours)
Different types of Files; Reading, Writing, Appending and Rewriting of Text and Binary Files; Transfer of Data in Blocks; Moving of File Pointer in a File; Usage of bitwise AND, OR, NOT, XOR, Shift Left and Shift Right Operations

Text Books
1. Bryon S.Gottfried, *Programming with C Language*.

Reference Books
1. Balaguruswamy, *Programming in ANSI C*,
2. Deitel, *How to Program C*
3. Kamthane, *Programming with ANSI and Turbo C*

ME010 306(CE) Strength of Materials & Structural Engineering

(Common with PE010 306(CE), AU010 306(CE) and PO010 306(CE))

Teaching Scheme:-
3 hours lecture and 1 hour tutorial per week **Credits**: 4

Objectives

- *To study internal effects produced and deformations of bodies caused by externally applied forces.*
- *To understand the stresses and strains in different materials and analyse strength characteristic of structural members.*

Module I (15 hours)

Introduction to analysis of deformable bodies:-
stresses due to normal, shear and bearing loads-Axial and shear strains –
Simple stresses and strains: Material behavior - uniaxial tension test - stress-strain diagrams. Hooke's law for linearly elastic isotropic material.
Elastic constants - relation between them - Bars of varying cross section -Composite sections-Equilibrium and compatibility conditions- Temperature stresses

Module II (10 hours)

Bending moment and shear force: Cantilever, simply supported and overhanging beams - concentrated and U.D loading(analytical method) Relation between load shear force and bending moment.

Module III (15 hours)

Stresses in beams: Pure bending - flexure formula for beams - assumptions and limitations -section modulus - flexural rigidity - economic sections beams of uniform strength. Shearing stress formula for beams - assumptions and limitations.
Deflection of beams: Moment-curvature relation - assumptions and limitations singularity functions - Macaulays method - moment area method for simple cases.

Module IV (10 hours)

Torsion: Torsion theory of elastic circular bars – solid and hollow shaft assumptions and limitations - polar modulus- torsional rigidity - economic cross-sections.
Pressure vessels: Thin and thick cylinders-Lame's equation-stresses in thick cylinders due to internal pressure – compound pipes.

Module V (10 hours)

Combined stresses: Principal stresses and planes-Mohr's circle representation of stress in 2D problems. Use of strain gage rosettes. Combined axial, flexural and torsional loads.
Theory of columns: Buckling theory -Euler's formula for long columns - assumptions and limitations - effect of end conditions - slenderness ratio - Rankine's formula for intermediate columns -Eccentric loading of columns - kern of a section (rectangular and circular section).

Text Books
1. Timoshenko.S.P, Strength of Materials, Part 1,D.Van Nostrand company, Inc.Newyork.
2. Bansal R.K., Strength of Materials, Lakshmi Publications, New Delhi.
3. Mott, Robert L, Applied strength of materials, 5th Edn, Prentice Hall of India.
4. Popov E.P., Engineering Mechanics of solids, Prentice Hall of India, New Delhi..

Reference Books
1. Nash.W.A , Strength of Materials, Schaum's Outlines,$th Edn, TMH
2. Gere, James M , Mechanics of Materials, Cengage Learning.
3. Shames IH , Pitarresi, James.M, Introduction to Solid Mechanics, Prentice Hall of India.

ME010 307: Computer Programming Lab

(Common with PE010 408 and AU010 307)

Objectives

- *To provide experience in programming with C language*
- *To familiarize with operating systems. file directories, editors, compilers and file managers etc.*
- *To obtain exposure to computer programming languages for technical computation like MatLab*
- *Programming experiments in C to cover control structures functions, arrays, structures, pointers and files*

i. Counting characters, lines and words
ii. Checking leap year
iii. Finding sum of digits and reversing a number
iv. Generating Prime numbers, Fibonacci numbers and Angstrom numbers
v. Sine and Cosine series generation
vi. Implementation of Numerical Integration using Simpson's and Trapezoidal rules
vii. Sorting of numbers, strings and records
viii. Matrix addition and multiplication
ix. Implementation of dynamic memory allocation
x. Implementation of linked lists
xi. Problems related to files
xii. Problems related to command line arguments

ME010 308: Fluid Mechanics Lab

(Common with AN010 308 , PE010 308 and AU010 308)

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To provide exposure to the actual flow process and various instruments adopted for flow measurement .*

- Study and acquire a thorough knowledge of the various pipe fittings and plumbing tools.
- Study the use of different types of taps, valves.
- Study the various measuring instruments like gauges, pitot tube, watermeters and current meters.
- Determination of metacentric height and radius of gyration of floating bodies.
- Determination of hydraulic coefficients of orifices and mouthpieces under constant head method and time of emptying method.
- Calibration of discharge measuring equipments in closed conduits like venturimeter, orificemeter, watermeter etc.
- Calibration of discharge measuring equipments in open channel flow like rectangular and triangular notches.
- Determination of Darcy's constant and Chezy's constant for pipe flow.
- Determination of critical velocity in pipe flow.
- Determination of minor losses in pipe flow.
- Experimental verification of Bernoulli's theorem.
- Determination of Chezy's constant and Manning's number for open channel flow.
- Calibration of Plug –Sluices.

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
30% - Viva voce

EN010401 Engineering Mathematics III

(Common to all branches)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Apply standard methods of mathematical &statistical analysis*

MODULE 1 Fourier series (12 hours)

Dirichlet conditions – Fourier series with period 2 π and 2l – Half range sine and cosine series – Harmonic Analysis – r.m.s Value

MODULE 2 Fourier Transform (12 hours)

Statement of Fourier integral theorem – Fourier transforms – derivative of transforms- convolution theorem (no proof) – Parsevals identity

MODULE 3 Partial differential equations (12 hours)

Formation by eliminating arbitrary constants and arbitrary functions – solution of Lagrange's equation – Charpits method –solution of Homogeneous partical differential equations with constant coefficients

MODULE 4 Probability distribution (12 hours)

Concept of random variable , probability distribution – Bernoulli's trial – Discrete distribution – Binomial distribution – its mean and variance- fitting of Binominal distribution – Poisson distribution as a limiting case of Binominal distribution – its mean and variance – fitting of Poisson distribution – continuous distribution- Uniform distribution – exponential distribution – its mean and variance – Normal distribution – Standard normal curve- its properties

MODULE 5 Testing of hypothesis (12 hours)

Populations and Samples – Hypothesis – level of significance – type I and type II error – Large samples tests – test of significance for single proportion, difference of proportion, single mean, difference of mean – chi –square test for variance- F test for equality of variances for small samples

References

1. Bali& Iyengar – A text books of Engg. Mathematics – Laxmi Publications Ltd.
2. M.K. Venkataraman – Engg. Mathematics vol II 3rd year part A & B – National Publishing Co.
3. I.N. Sneddon – Elements of partial differential equations – Mc Graw Hill
4. B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
5. Richard A Johnson – Miller Fread's probability & Statistics for Engineers- Pearson/ PHI

6. T. Veerarajan – Engg. Mathematics – Mc Graw Hill
7. G. Haribaskaran – Probability, Queueing theory and reliability Engg. – Laxmi Publications
8. V. Sundarapandian - probability ,Statistics and Queueing theory – PHI
9. H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International
10. A.K.Mukhopadhyay-Mathematical Methods For Engineers and Physicists-I.K.International

EN010 402(ME): Principles of Management

(Common with EN010 502(ME))

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To develop an understanding of different functional areas of management.*
- *To understand the functions and duties an individual should perform in an organisation.*

Module I (12 hours)

Management Concepts: Vision, Mission, Goals and Objectives of management-MBO- Scientific management- Functions of management- Planning- Organizing- Staffing- Directing- Motivating- Communicating- Coordinating- Controlling- Authority and Responsibility- Delegation- Span of control- Organizational structure- Line, Line and staff and Functional relationship.

Module II (12 hours)

Personnel Management: Definition and concept- Objectives of personnel management- Manpower planning- Recruitment and Selection of manpower- Training and development of manpower- Labour welfare- Labour turnover- Quality circle- Industrial fatigue- Industrial disputes-Method of settling disputes- Trade unions.

Module III (12 hours)

Production management: Objectives and scope of production management- Functions of production department- production management frame work- product life cycle-Types of production- Production procedure- Project planning with CPM and PERT- Basic concepts in network.

Module IV (12 hours)

Financial Management: Objectives and Functions of Financial Management- Types of Capital- Factors affecting working capital- Methods of financing.
Cost Management: Elements of cost- Components of cost- Selling Price of a product.

Module V (12 hours)

Sales and Marketing Management: Sales management- Concept- Functions of sales department- Duties of sales engineer- Selling concept and Marketing concept- Marketing- Definition and principles of marketing- Marketing management and its functions- Sales forecasting- Pricing- Advertising- Sales promotion- Channels of distribution- Market research.

Text Books

1. Koontz and Weihrich, *Essentials of Management*, Tata McGraw Hill.
2. Mahajan M., *Industrial Engineering and Production Management*, Dhanpat Rai and Co.
3. Kemthose and Deepak, *Industrial Engineering an Management,* Prentice Hall of India.

Reference Books

1. Martand Telsang, *Industrial Engineering and Production Management.*
2. Khanna O.P., *Industrial Engineering and Management,* Dhanpat Rai and Co.
3. Philip Kotler, *Marketing Management*, Prentice Hall of India.
4. Sharma S. C. & Banga T. R., *Industrial Organisation and Engineering Economics,* Khanna Publishers.
5. Prasanna Chandra, *Financial Management,* Tata McGraw Hill.

ME010 403: Hydraulic Machines

(Common with PE010 403)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart knowledge regarding principles and operations of various hydraulic machines.*

Module I (12 hours)

Dynamic Action of Fluid*:* Impulse Momentum equation- applications– impact of jet – flow of an incompressible fluid over fixed and moving vanes – workdone and efficiency – reaction principle – propulsion of ships. Basic equation of energy transfer in rotodynamic machines-components of energy transfer-Classification-Axial flow, radial flow, impulse and reaction machines.

Module II (12 hours)

Hydraulic turbines*:* Classification-– impulse and reaction turbines – Euler`s turbine equation-velocity triangles - Pelton wheel, Francis turbine Kaplan turbine – construction features and performance characteristics – theory of draft tube – speed regulation of turbines – run away speed- selection, type and speed of turbines

Module III (12 hours)

Pumping machinery*:* General classification –Rotodynamic pumps - construction features-classification of impellers, impeller shapes – types of casings -working of centrifugal pumps, priming, Euler`s head equation – velocity triangles – losses, head and efficiencies– performance pump characteristics: main, operating characteristics curves- selection of pumps from performance curves – $NPSH_{required}$– $NPSH_{available}$– multistage pumps – pumps in parallel & series operation- propeller pumps.

Module IV (12 hours)

Dimensional analysis – Rayleigh' s method – Buckingham's Pi theorem – non diamesional parameters in fluid mechanics and fluid machinery – principle of similitude, geometric, kinematic and dynamic similarity – model studies. Non dimensional numbers (Reynold's number, Froude's number, Euler's number, Weber's number and Mach's number) Non dimensional parameters for incompressible flow machines –Capacity coefficient, Head coefficient, Power coefficient, Reynolds number, shape number, specific speed – Non dimensional performance curves for pumps- effect of change of outlet vane angle, impeller diameters and speed–Principle of similitude- Non dimensional parameters for comparative study of turbine performance – unit speed, unit power, unit quantity, geometric similarity – model laws – effect of specific speed on runner speed, runner size, flow type etc. Cavitation in fluid machines – installations susceptible to cavitation – collapse of bubble theory – Thoma`s prameter – factors affecting cavitation in pumps and turbines –prevention of cavitation damage.

Module V (12 hours)

Positive displacement pumps*:* reciprocating pump, effect of vapour pressure on lifting of liquid – indicator diagram – acceleration head – effect of friction – use of air vessels – work saved – Slip - efficiency – pump characteristics – applications.

Theory & application of self-priming pump, jet pump, airlift or compressor pump, slurry pump, hydraulic ram - Positive displacement Rotary pumps*:* Gear, screw, vane pumps.

Hydraulic accumulator, intensifier, fluid coupling & lift – principle of operation- hydraulic cranes, hydraulic press- Hydraulic symbols (Description only, no problems).

Text Books

1. Jagadishlal, *Hydraulic Machines*, Metropolitan Publishers.

Reference Books

1. Abdulla Sheriff ,*Hydraulic machines*, standard publishers.
2. Govinda Rao N. S, *Fluid flows machines*, TMH.
3. Pippinger, *Industrial hydraulics*.
4. Stepanoff John A. J, *Centrifugal and axial flow pumps*, iley & sons
5. Lewitt E. H, *Hydraulic & Fluid Mechanics*
6. Som S K and Biswas G, *Introduction to fluid mechanics and fluid machines*, TMH.
7. Yahya S M, *Turbines fans and compressors,* TMH.
8. R.K.Rajput, *Hydraulic Machines*, S.Chand & Company.
9. Modi & Seth, *Hydraulic Machines*, Laxmi Publications, New Delhi

ME010 404: Manufacturing Process

(Common with AU010 404)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To gain theoretical and practical knowledge in material casting processes and develops an understanding of the dependent and independent variables which control materials casting in a production processes.*
2. *Provide a detailed discussion on the welding process and the physics of welding. Introduce students to different welding processes weld testing and advanced processes to be able to appreciate the practical applications of welding.*
3. *The course will also provide methods of analysis allowing a mathematical/physical description of forming processes.*

Module I (12 hours)

Patterns: - types, allowances, color code **–** Molding sand**:-** constituents, types, properties, testing, types of mould, molding machines **–** Cores**:-** sands, types prints, machines, chaplets, forces acting on molding flasks - Gating system**:-** fluid flow and heat transfer in metal casting, elements and design of gating system, sprue, gating ratio, slag trap system – Risering:- risering design, chills, feeding devices - Cupola operation -pouring and cleaning of castings - defects in castings - inspection and quality control - Casting**:-** continuous, strip, shell mold, vacuum, investment, slush, pressure, die, centrifugal, precision investment, squeeze casting and semi solid metal forming, economics and surface finish obtainable - casting machines - comparison of casting with other production processes. (Include necessary figures and equations).

Module II (12 hours)

Welding**:-** diffusion, definition of welding, metallurgy of welding, applications, classification, mechanism - welding design:- effect of weld parameters on weld quality, heat input, heat flow and distortions - Gas welding:- details, equipment, fluxes and filler rods – flame cutting - Arc welding:- applications, equipment, polarity, governing factor in fusion welding - electrodes and types – TIG - GMA - CO_2 process - Submerged arc, electroslag, plasma arc and flux cored arc welding - Resistance, thermit solid state welding - Electron and laser beam welding – explosive welding - inspection and defects in welding - heat affected zone, grain size variations in joint strength - Brazing and soldering - adhesive bonding – Extrusion**:** Metal flow – mechanism and types – extrusion defects.

Module III (12 hours)

Rolling**:-** principles - types of rolls and rolling mills - mechanics of flat rolling, roll pressure distribution - neutral point - front and back tension, roll forces in hot rolling, roll torque and power, friction, deflection and flattening - friction and lubrication in metal forming - defects - hot and cold rolling - rolling machines - strip velocity and roll velocity - roll and roll pass design - theories of rolling and effect of parameters - load calculation - rolling of tubes, wheels, axles, I-beam thread, gear rolling.

Module IV 12 hours)

Forging**:-** classification - open die forging, forces and work of deformation - Forging methods analysis:- slab method only, solid cylindrical, rectangular work piece in plane strain, forging under sticking condition - deformation zone geometry – die forging:- impression, close, coining, skew rolling etc. – defects in forging – forgeability tests – die design and materials – equipments - heating in forging - quality assurance for forging -non destructive testing - mechanics of rod and wire Drawing:- ideal deformation, ideal deformation and friction, drawing of flat strips etc – drawing defects – drawing practices.

Module V (12 hours)
Locating methods:- methods, degrees of freedom - principle of clamping:- clamping types - work holding principle – Die cutting:- Different types - shearing - types of presses –cutting action in punch and die operations – die clearances – types of die:- progressive, compound, combination die – Bending dies:- bending methods, minimum bend radius, bendability, spring back, forces, bend allowances – Forming dies:- solid form, curling, embossing, coining, bulging dies - Shear and tube spinning - High energy rate forming:- need, energy sources - material behavior - pneumatic, mechanical, electrohydraulic, electromagnetic, and explosive forming – Deep drawing:- deep drawability, punch forces.

Text Books

1. Manufacturing Science - Amitabha Ghosh and Ashok Kumar Mallick
2. Manufacturing Engineering and Technology - Kalapakjian and Schmid

Reference Books

1. Principles of Metal Casting - Hine and Rosenthal
2. Foundry Technology - P.R.Beeley

ME010 405: Machine Drawing

(Common with PE010 405 and AU010 405)

Teaching scheme **Credits:4**

3 hours practical and 1 hour theory per week

Objectives :

- *To impart the fundamental concepts of machine drawing.*
- *To develop primary knowledge of working drawings.*
- *To produce orthographic drawing of different machine parts.*
- *To develop skill to produce assembly drawings.*
- *To develop skill to produce detailed drawings of machines parts from assembly drawing.*

Module-1(15hrs)

Conversion of pictorial views into orthographic views-dimensioning techniques-preparation of drawing- - Limits and tolerances of machine parts - Hole system and shaft system of tolerances - Designation of fundamental deviation - Types of fits and their selection - Indication of dimensional tolerances and fits on simple machine parts - Geometrical tolerances – Recommended symbols - Indication of geometrical tolerances on simple machine parts - Surface roughness – Indication of surface finish on drawings - Preparation of shop floor drawings of simple machine parts.

Types of screw threads-different forms-conventional representation-sketching orthographic views of hexagonal bolts and nuts -dimensional drawing-square headed bolts and nuts –sketching of different types of lock nuts and locking devices- foundation bolts.

Forms of rivet heads – riveted joints-lap and butt joints with single and multiple riveting in chain and zig – zag arrangements –dimensional drawing. Sketching of conventional representation of welded joint.

Module-2 (20 hrs)

Fully dimensioned and sectional drawing of the following Joints-

knuckle joint-jib and cotter

shaft couplings-types of keys- protected types of flanged couplings-bushed pin type flexible coupling-

Oldham's coupling

Pipe joints-spigot and socket joint-flanged joint-

Shaft bearings and support-Plummer block IC engine parts-piston-connecting rod

Module-3(25hrs)

Assembly and working drawings of the followingValves

-stop valve-spring loaded safety valve –dead weight safety valve-feed check valve-feed check valve

Machine elements-screw jack –lathe tool post-spindle-tailstock

Note:

- Drawing practical classes have to be conducted by using any standard CAD software and using drawing instruments in alternate weeks (3Hours) preferably for each half of the student.

  Semester End examination (3Hours) shall be conducted by using drawing instruments only
- All drawing exercises mentioned above are for class work. Additional exercises wherever necessary may be given as homework
-

References:

1. N.D.Bhatt and Panchal, *Machine Drawing*, Charator Publishing House
2. P I.Varghese, *Machine Drawing*, VIP Publishers, Thrissur
3. Ajeet Singh, *Machine Drawing*, Tata McGraw Hill Education Private Ltd
4. P.S.Gill , *Machine Drawing*, S.K.Kataria &Sons

University examination pattern

Question I: Two questions of 7.5 marks each out of three questions from module-1

Question II: One questions of 25 marks from module-2.

Question III:One question of 60 marks from module-3

ME 010 406(EE) Electrical Technology

(Common with PE010 406 (EE) and AU010 406 (EE))

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

Understanding the basic working principles of DC machines Ac machines and its drives

Module I (8 hours)

D.C. Generator - O.C.C. – Condition for self excitation – field critical resistance – critical speed - Load characteristics of generators- Losses- power flow diagram- efficiency- condition for maximum efficiency- Application.

Module II (16 hours)

D.C. Motors**:** Back emf – speed and torque equation- starting and speed control – testing of D.C. Motors – brake test – Swinburn's test- Performance characteristics of Shunt, Series and Compound motors. **-** Applications

Transformer – Emf equation: No load current – equivalent circuit – regulation- efficiency. Determination of regulation and efficiency from O.C. and S.C. tests – cooling of transformer. Basic principle of 3 phase transformer **-** Applications

Module III (13 hours)

Alternators **-** Construction details**:** Type – emf equation (winding factor need not be derived) – synchronous impedance – regulation by emf and mmf method.

Synchronous Motors**:** Principle of operation – method of starting.

Three phase induction motor: Production of rotating magnetic field **-** equivalent circuit – torque equation – torque slip characteristics – no load and blocked rotor tests – starting and speed control – Application

Single Phase motor: Different types - Application.

Module IV (13 hours)

Industrial drives – electric drives – advantages – individual drive and group drive – factors affecting choice of motor – mechanical characteristics of a.C. and D.C. motors – motors for particular application like textile mill, steel mill, paper mill, mine, hoists, crane etc. – size and rating of motor . Electric traction – Different systems of traction – comparison – track electrification – different systems – traction motor characteristics – electric braking – plugging – Dynamic and regenerative braking.

Module V (10 hours)

Power semiconductor devices: power diodes – SCR's **-** principle of operation of SCR's – two transistor analogy of SCR – characteristics – SCR rating (basic principle only). High frequency heating – induction and dielectric heating – resistance heating resistance welding- block schematic of resistance welding scheme.

Text Books

1. Dr. P S Bimbra, *Electrical Machinery*, Khanna Publishers
2. J B Gupta, *Electrical Machines* , S K Kataria and Sons
3. Dr. P S Bimbra, *Power Electronics,* Khanna Publishers

Reference Books

1. Alexander Langsdorf A S: Theory of AC Machinery, Mc-Graw Hill
2. Say M G: Performance and design of AC Machines, ELBS
3. Electrical machines, Drives and Power Systems: Thoedore Wildi, Pearson Ed.
4. P.C. Sen, *Thyristor DC Drives*, Wiley-Interscience Publication 1984
5. Joseph Vithayathil, *Power Electronics-Principles and applications*, TMH, 2010
6. B. K. Bose, Modern Power Electronics and A.C. Drives, PHI, 2002.
7. G.K. Dubey, *Fundamentals of Electrical Drives*, Narosa Publishing House, New Delhi,2005

ME010 407: Hydraulic Machines Laboratory
(Common with PE010 407)

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives
- *To provide experience on various Hydraulic machineries.*
- *To acquaint the students with the measurement of various parameters.*

Experiments

Performance characteristic tests on Pelton wheel (Load test & best speed).
Performance characteristic tests on Francis turbine (Load test & best gate opening).
Performance characteristic tests on Kaplan turbine (Load test & best gate, vane angle opening).
Performance characteristic tests on single stage, multi stage centrifugal pumps at constant speed & at variable speed. Actual & predicted curves.
Performance characteristic tests on self-priming pump, Jet pump, Airlift pump and deep well pump
Performance characteristic tests on axial flow pump.
Performance characteristic tests on Hydraulic ram.
Performance characteristic tests on reciprocating pump at constant speed.
Performance characteristic tests on Gear pump.
Performance characteristic tests on Screw pump.

Text Books

1. Abdulla Sheriff, *Fluid Mechanics & Hydraulic Machines*: Standard Publ.
2. R.K Bansal, *Fliud Machines and Hydraulic Machines* , Lakshmi publications New Delhi

Reference Books

1. K Subramanya , *Fluid Machines and Hydraulic Machines* , TMH.
2. Govinda Rao N.S, *Fluid Flows Machines*, TMH.
3. Shiv Kumar, *Fluid Mechanics & Fluid machines* , Ane books.
4. Massey B. S, *Fluid Mechanics*, ELBS
5. Stepanoff John A. J, *Centrifugal and Axial Flow Pump*, Wiley & Sons

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
30% - Viva voce

ME010 408 STRENGTH OF MATERIALS LAB
(Common with PE010 307 and AU010 408)

Teaching scheme **Credits: 2**
3 hours practical per week

Objective: *To study properties of various materials*

List of Experiments

1. Tests on springs (open and close coiled)
2. Bending Test on Wooden Beams using U. T. M.
3. Verification of Clerk. Maxwell's Law of reciprocal deflection and Determination of Youngs modulus'E 'for steel.
4. Torsion Pendulum (M.S. wires. Aluminum wires and brass wires)
5. Tension test using U. T. M. on M. S. Rod, torsteel and High Tensile steel.
6. Torsion Test on M. S. Rod.
7. Shear Test on M.S. Rod.
8. Fatigue Test
9. Impact Test (Izod and Charpy)
10. Hardness Test (Brinell, Vicker's and Rebound)
11. Strut Test.

Note
All tests should be done as per relevant BIS.

References

1. Timoshenko.S.P, Strength of Materials, Part-1, D.Van Nostrand company, Inc.Newyork.
2. Bansal R.K., Strength of Materials, Lakshmi Publications, New Delhi.
3. Bhavikatti S.S , Strength of Materials, Vikas Publishing House (P) Ltd.
4. D.S. Prakash Rao, Strength of Materials, Vol. I, University Press (India) Ltd.
5. Popov E.P., Engineering Mechanics of solids, Prentice Hall of India, New Deihi.
6. Punmia B.C, Strength of Materials and Mechanics of structures, Vol.1, Lakshmi Publications, New Delhi.

EN010501A ENGINEERING MATHEMATICS IV

(Common to all branches except CS & IT)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Use basic numerical techniques to solve problems and provide scientific techniques to decision making problems.*

MODULE 1 Function of Complex variable (12 hours)

Analytic functions – Derivation of C.R. equations in cartision co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal mapping of z^2 , $\frac{1}{z}$ - Bilinear transformation – cross ratio – invariant property (no proof) – simple problems

MODULE 2 Complex integration (12 hours)

Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's series- Laurent's series – Zeros and singularities – types of singularities – Residues – Residue theorem – evaluation of real integrals in unit circle – contour integral in semi circle when poles lie on imaginary axis.

MODULE 3 Numerical solution of algebraic and transcendental equations (10 hours)

Successive bisection method – Regula –falsi method – Newton –Raphson method - Secant method – solution of system of linear equation by Gauss – Seidel method

MODULE 4 Numerical solution of Ordinary differential equations (10 hours)

Taylor's series method – Euler's method – modified Euler's method – Runge – Kutta method (IV order) - Milnes predictor – corrector method

MODULE 5 Linear programming problem (16 hours)

Definition of L.P.P., solution, optimal solution, degenerate solution – graphical solution –solution using simplex method (non degenerate case only) Big -M method – Duality in L.P.P. – Transportation problem –Balanced T.P. – initial solution using Vogel's approximation method - modi method (non degenerate case only)

References

1. B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
2. M.R.Spicgel , S.Lipschutz , John J. Schiller, D.Spellman – Complex variables, schanm's outline series - Mc Graw Hill
3. S.Bathul – text book of Engg.Mathematics – Special functions and complex variables –PHI
4. B.S. Grewal – Numerical methods in Engg. and science - Khanna Publishers
5. Dr.M.K Venkataraman- Numerical methods in science and Engg -National publishing co

6. S.S Sastry - Introductory methods of Numerical Analysis -PHI
7. P.K.Gupta and D.S. Hira – Operations Research – S.Chand
8. Panneer Selvam– Operations Research – PHI
9. H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International

ME010 502 Computer Aided Design & Manufacturing

(Common with PE010 604 and AU010 502)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide a comprehensive concepts of the design aspects and its importance in computer assisted design and manufacture.*
- *To examine technologies those have been developed to automate manufacturing* operations.

Module 1 (12 hours)

Evolution of CAD/CAM and CIM, computers and workstation, elements of interactive graphics, input/ out put display, storage devices in CAD, – networking of CAD systems - 2D Graphics: line drawing algorithms, DDA line algorithm – circle drawing, bressnham`s circle drawing algorithm– 2D Transformation: translation, rotation, scaling, reflection – clipping -3D Graphics (basic only).

Module 2 (12 hours)

Geometric modeling: Wire frame, surface and solid modeling - Engineering analysis; design review and evaluation, automated drafting.

Numerical control: Need - advantages and disadvantages – classifications – Point to point, straight cut and contouring positioning - incremental and absolute systems – open loop and closed loop systems – DDA integrator and Interpolators – resolution – CNC and DNC.

Programmable Logic Controllers (PLC)**:** need – relays - logic ladder program – timers, simple problems only - Devices in N.C. systems: Driving devices - feed back devices: encoders, moire fringes, digitizer, resolver, inductosyn, and tachometer.

Module 3 (12 hours)

NC part programming: part programming fundamentals - manual programming – NC co-ordinate systems and axes – tape format – sequence number, preparatory functions, dimension words, speed word, feed world, tool world, miscellaneous functions – programming exercises.

Computer aided part programming: concept and need of CAP – CNC languages – APT language structure: geometry commands, motion commands, postprocessor commands, compilation control commands – programming exercises – programming with interactive graphics.

(At least one programming exercise should be included in the University examination)

Module 4 (12 hours)

Computer Aided Process Planning (CAPP): concepts; traditional and CAPP; automated process planning: process planning, general methodology of group technology, code

structures of variant and generative process planning methods, AI in process planning, process planning software.
Flexible Manufacturing Systems (FMS): Introduction, types, concepts, need and advantages of FMS - cellular and FMS - JIT and GT applied to FMS.

Module 5 (12 hours)

Robot Technology**:** overview, basic components - robot end effectors – sensors in robotics – control of actuators in robotic mechanisms (basic only) – control of robo joint, stepper motor, direct drive actuators – hydraulic and pneumatic systems (basic only) – robot arm kinematics, direct and inverse kinematics solution robot arm dynamics – robot applications: material transfer, machine loading and unloading, pre cutting operations, assembly, inspection and welding.

TEXT BOOKS:

1. Newman and Sproull - Principles of interactive Graphics, McGraw – Hill.
2. Yoram Koren - Numerical control of machine tools, McGraw-Hill.

REFERENCE BOOKS:

1. Craig John - Introduction to Robotics
2. Groover M.P. - CAD/CAM, PHI.
3. Hearn and Baker - Computer graphics (in C version), Prentice Hall.
4. Petruzella Frank.D. - Programmable logic controllers.
5. Jonn Craig - Introduction to Robotics

ME010 503: Advanced Mechanics of Materials

(Common with PE010 503)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

1. *To impart concepts of stress and strain analysis in a solid.*
2. *To study the methodologies in theory of elasticity at a basic level.*
3. *To acquaint with energy methods to solve structural problems.*

Module I (12 hours)

Basic equations of Elasticity, Stress at a point with respect to a plane - normal and tangential components of stress - stress tensor - Cauchy's equations - stress transformation - principal stresses and planes - strain at a point - strain tensor - analogy between stress and strain tensors - constitutive equations - generalized Hooke's law - relation among elastic constants – equations of equilibrium -strain-displacement relations –

Module II (12 hours)

Compatibility conditions - boundary conditions - Saint Venant's principle for end effects –uniqueness condition. 2-D problems in elasticity. Plane stress and plane strain problems – Airy's stress function – solutions by polynomial method – solutions for bending of a cantilever with an end load and bending of a beam under uniform load.

Module III (12 hours)

Equations in polar coordinates - Lame's problem - stress concentration problem of a small hole in a large plate. Axisymmetric problems - thick cylinders - interference fit - rotating discs. **S**pecial problems in bending: Unsymmetrical bending - shear center - curved beams with circular and rectangular cross-section

Module IV (12 hours)

Energy methods in elasticity: Strain energy of deformation - special cases of a body subjected to concentrated loads, due to axial force, shear force, bending moment and torque – reciprocal relation -Maxwell reciprocal theorem - Castigliano's first and second theorems - virtual work principle -minimum potential energy theorem - complementary energy

Module V (12 hours)

Torsion of non-circular bars: Saint Venant's theory - Prandtle's method - solutions for circular and elliptical cross-sections - membrane analogy - torsion of thin walled open and closed sections- shear flow

Text Books

1. L. S. Sreenath, Advanced Mechanics of Solids, McGraw Hill
2. S. M. A. Kazimi, Solid Mechanics, McGraw Hill
3. S. P. Timoshenko, J. N. Goodier, Theory of elasticity, McGraw Hill

Reference Books

1. J. P. Den Hartog, Advance Strength of Materials, McGraw Hill
2. C. K. Wang, Applied Elasticity, McGraw Hill

ME010 504: Kinematics of Machinery

(Common with AU010 504)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To understand the basic components and layout of linkages in the assembly of a system/machine.*
2. *To understand the principles involved in assembly the displacement, velocity and acceleration at any point in a link of a mechanism.*
3. *To understand the motion resulting from a specified set of linkages.*
4. *To understand and to design few linkage mechanisms and cam mechanisms for specified output motions.*
5. *To understand the basic concepts of toothed gearing and kinematics of gear trains.*

Module I (14hours)

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law –Kinematic inversions of four-bar chain, slider crank chains and double slider crank chains – Limit positions –Mechanical advantage – Transmission Angle -Coupler curves – Description of some common Mechanisms – Quick return mechanisms, Straight line generators, Dwell Mechanisms, Ratchets and Escapements, Universal Joint, steering mechanisms

Module II (12hours)

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method – Velocity and acceleration polygons – Velocity analysis using instantaneous centers – Kennedy's theorem, kinematic analysis by complex algebra methods – Vector approach – Computer applications in the kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration.

Module III (10hours)

Kinematic synthesis (Planar Mechanisms) - Tasks of kinematic synthesis – Type, Number and dimensional synthesis – Precision points - Graphical synthesis for four link mechanism Function generator – 2 position and 3 position synthesis – Overlay Method - Analytical synthesis techniques

Module IV (12 hours)

Cams and Followers: - types-follower motion-SHM-uniform velocity and acceleration-Cycloidal - displacement, velocity and acceleration curves-Cam profile-Reciprocating and oscillating followers-Tangent cams-Convex and concave cams with footed followers. Introduction to Polynomial cams.

Module V (12 hours)

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting – Non-standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears [Basics only] Gear trains – Speed ratio, train value – Parallel axis gear trains– Epicyclic Gear Trains – Differentials

Reference Books

1. R L Norton, Kinematics and Dynamics of Machinery, 1st ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
2. J. E. Shigley, J. J. Uicker, *Theory of Machines and Mechanisms*, McGraw Hill
3. S .S Rattan Theory of Machines, 3rd ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
4. A. Ghosh, A. K. Malik, *Theory of Mechanisms and Machines*, Affiliated East West Press
5. A. G. Erdman, G. N. Sandor, *Mechanism Design: Analysis and synthesis Vol I & II*, Prentice Hall of India

ME010 505 I. C. Engines & Combustion

(Common with AU010 505)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of IC Engine and Combustion*

Module I (15 hours)

Working of two stroke and four stroke engines and valve timing diagrams of – Petrol and diesel engine. (Review only). Fuel air cycles. Ignition systems- Battery and magneto systems- ignition timing and spark advance. Fuels – Qualities, rating of fuels - Octane and Cetane numbers. Alternative fuels.

Types of engines - Wankel engine,- Stirling engine - Stratified charge engine - VCR engine - free piston engine.

Module II (15 hours)

Air fuel mixture requirements – Solex Carburettor. Stoichiometric and excess air calculations. Fuel injection systems in SI and CI engines - Fuel injection pumps.- nozzle- direct and indirect injections. MPFI systems and GDI engines. CRDI technology.

Lubrication systems- types – properties of lubricants. Flash point, fire point and viscosity index.

Module III (10 hours)

Thermodynamics of combustion. Combustion reaction of common fuels. Exhaust gas composition. Flue gas analysis. Air fuel ratio from exhaust gas composition. Variation of specific heats- heat losses- Dissociation.

Engine cooling systems- Air and liquid system- Super charging and turbo charging

Module IV (10 hours)

Combustion in SI engines- P-θ diagram- Stages of combustions- Ignition lag. Flame propagation – Abnormal combustion – detonation effects. Combustion in CI engines, P-θ diagram - Ignition delay, diesel knock- controlling methods.

Air motion- Squish, tumble, swirl motions. Different types combustion chamber for SI and CI engines.

Module V (10 hours)

Pollutants in SI and CI engines. NOx, CO, unburned hydrocarbons ,smoke and particulate. Measurement of exhaust emission. (HC, CO, NOx and smoke intensity) Exhaust gas treatment.- Catalytic converter – Thermal reaction -Particulate trap.

Testing of IC engines - Indicated power – Brake Power - Volumetric efficiency - Heat balance test - Morse test.

Text Books

V Ganesan, *Internal Combustion Engine* Tata Mc Graw Hill Publishing Company Ltd. New Delhi 2006. -

Reference Books

John B Heywood, Internal Combustion Engine Fundamentals, Mc Graw Hill Publishing Company Sigapur,1998.

Obert E F,Internal Combustion Engine and air Pollution Mc Graw Hill book company New York.

Mathur and Sharma,A course in Internal Combustion Engine - Dhanpat Rai Publications new Delhi, 2004.

Sharma S.P, Fuels and Combustion, Tata Mc Graw Hill Publishing Company Ltd. New Delhi.1990.

Spalding D.B. Some Fundamentals of Combustion Better Worths Scientific Publications London, 1955.

ME010 506 Thermodynamics

(Common with PE 010 506 and AU010 506)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Thermodynamics*

Pre-requisites: *Knowledge required to study this subject (especially any subject previously studied)*

Module I (10 hours)

Fundamentals concepts – scope and limitations of thermodynamics. Thermodynamic systems – different types of systems – macroscopic and microscopic analysis – continuum – Properties – state – processes. Thermodynamics equilibrium – Equation of state of an ideal gas – PVT system – Real gas relations – Compressibility factor – Law of corresponding states.

Module II (15 hours)

Laws of thermodynamics- Zeroth law of thermodynamics – Thermal equilibrium – Concept of temperature – Temperature scales – Thermometry – Perfect gas temperature scales. – Thermometry – Perfect gas temperature scales. Work and heat – First law of thermodynamics – Concept of energy _ First law for closed and open systems – Specific heats – internal energy and enthalpy – Steady flow energy equations _ Jule Thompson effect.

Module III (15 hours)

Second law of thermodynamics- Various statements and their equivalence_ Reversible process and reversible cycles- Carnot cycles- Corollaries of the second law – thermodynamics temperature scales – Clausis inequality- Concept of entropy – Calculation of change in entropy in various thermodynamic processes – Reversibility and irreversibility – Available and unavailable energy – Third law of thermodynamics.

Module IV (10 hours)

Thermodynamic relations – Combined first and second law equations – Hemholtz and gibbs functions – Maxwell relations- Equations for specific heats, internal energy, enthalpy and entropy – Clausius Clapeyron equations _ applications of thermo dynamic relations.

Module V (10 hours)

Properties of pure substances – PVT, PT and TS diagrams, Mollier diagrams- Mixture of gases and vapours- mixture of ideal gases – Dalton's law – Gibbs law- Thermodynamic properties of mixtures

Text Books

1 P K Nag, *Engineering Thermodynamics*, Tata Mc Graw Hill Publishing Company Ltd. New Delhi 2008.

Reference Books

1. J. F. Lee and FW Sears, *Engineering Thermodynamics*, Addison-Wesleg Publishing Company, London, 1962.
2. Spalding and Cole, *Engineering Thermodynamics*, The English Language Book Society and Edward Arnold Ltd.,1976.
3. M. A.chuthan, *Engineering Thermodynamics*,Prentice Hall of India Private Ltd, New Delhi 2002.
4. J.H Keenan, *Thermodynamics*, John Wiley and Sons , New York, 1963.
5. Edward F Obert, *Concept of Thermodynamics*, McGraw Hill book company New York, 1988.
6. J.P. Holman, *Thermodynamics*, McGraw Hill book company New York, 1988.
7. Mark W. Zemansky, *Heat and Thermodynamic*, McGraw Hill, New Delhi, 2001.
8 Roy T, *Basic Engineering Thermodynamics*, Tata Mc Graw Hill Publishing Company Ltd. New Delhi 1989.

ME010 507**: CAD/CAM Lab**

(Common with PE010 708)

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To train the students in solid modelling, surface modelling and drafting*
- *To gain experience in assembly modelling, mechanism design and systems routing*
- *To practise computer controlled manufacturing methods*
- *To expose students to rapid prototyping*

Solid Modeling (15 hours)

Creation of 3D models-Wireframe, Surface and Solid modeling techniques using CAD packages- Parametric modeling-Drafting-Generation of orthographic 2D views from models,Sectioning,Detailing –Exposure to Industrial components-Application of Geometrical Dimensioning &Tolerancing.

Assembly Design (15 hours)

Assembling of various machine parts and tolerance analysis, generation of 2D drawings and bill of materials from assembly
Mechanism Design - synthesis and design of mechanisms - animations - exercises on various mechanisms like four bar chain, slider crank mechanism and its inversions
System Design-Schematic and non schematic driven routing of pipes and tubes,

Computer aided manufacturing (15 hours)

Part programming fundamentals - manual part programming and computer aided part programming - hands on training in computer controlled turning and milling operations - tool path generation and simulation - exercises on CNC lathe and machining center/milling machines
Generation of STL files and rapid prototyping of CAD models

Exercises

1) Modeling of machine parts, brackets using 2D drawings
2) Modeling of surfaces using given master geometry
3) Parametric modeling of standard parts such as nuts, bolts, rivets, washers etc
4) Assembling of machine parts
5) Generation of manufacturing drawings from 3D models/assembly
6) Synthesis of four bar mechanism and its simulation using software packages
7) Synthesis of slider crank mechanism and its simulation using software packages
8) Schematic and non schematic routing of pipes/tubes
9) Manual/Computer aided part programming for turning and milling operations
10) Rapid prototyping of simple CAD models

Reference Books

1. CAD and Solid Modeling Software Packages CATIAV5, UNIGRAPHICS and PRO-E Manuals of Latest Version
2. Ibrahim Zeid, R Sivasubrahmanian CAD/CAM: Theory & Practice *Tata McGraw Hill Education Private Limited*, Delhi,
3. Yoram Koren, Computer Control of Manufacturing Systems *Tata McGraw Hill Education Private Limited*, Delhi,
4. Peter Smid, (2003), CNC programming Handbook a comprehensive guide to practical CNC programming, Industrial Press

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

Note: Exercise in Rapid prototyping may be demonstrated for the entire batch

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, modeling steps, results
30% - Viva voce

ME010 508 Electrical & Electronics Lab

(Common with PE010 508 and AU010 508)

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To conduct various tests on Electrical Machines and to study their performance.*
- *To conduct various tests on practical electronic circuits*

PART A

1. Study of 3-point and 4-point starters for D.C machines

2. OCC of self excited D.C machines – critical resistances of various speeds. Voltage built-up with a given field circuit resistance. Critical speed for a given field circuit resistance

3. OCC of separately excited D.C machines

4. Load test on shunt generator – deduce external, internal and armature reaction characteristics.

5. Load test on compound generator

6. Swinburne's test on D.C machines

7. Brake test on D.C shunt motors and determination of characteristics.

8. Brake test on D.C series motors and determination of characteristics.

9. Brake test on D.C compound motors and determination of characteristics.

10. O.C and S.C tests on single phase transformers – calculation of performance using equivalent circuit – efficiency, regulation at unity, lagging and leading power factors.

11. Load test on single phase transformers.

12. Alternator regulation by emf and mmf methods

13. Study of starters for three phase induction motors

14. Load tests on three phase squirrel cage induction motors

15. Load tests on three phase slip ring induction motors

16. Load tests on single phase induction motors

PART B

1. Design and testing of clipping and clamping circuits

2. Design and testing of of RC integrator and differentiator circuits.

3. Design and testing of rectifier circuits – Half wave – Full wave (centre – tapped and bridge) circuits. Filter circuits.

4. Design and testing of RC coupled amplifier– frequency response.
Sweep circuits

5. Design and Testing of RC phase-shift Oscillator

References

1. Dr. P S Bimbra, *Electrical Machinery*, Khanna Publishers
2. R K Rajput, *A text book of Electrical Machines,* Laxmi publishers
3. A.P. Malvino*, Electronic Principles*– TMH
4. Floyd, *Electronic Devices*, Pearson Education, LPE

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
30% - Viva voce

ME010 601 Mechanics of Machines

(Common with AU010 601)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- To understand the method of static force analysis and dynamic force analysis of mechanisms
- To understand the principles of governors and gyroscopes.
- To understand the design of flywheel
- To understand the working of different types of brakes and dynamometers

Module I (14 hours)

Force analysis of machinery - static and dynamic force analysis of plane motion mechanisms - graphical method - principle of superposition –matrix methods - method of virtual work.

Module II (12 hours)

Governors: - terminology; Watt, Porter, Proel, Hartnell, Hartung, Wilson-Hartnell, and Pickering governors-spring controlled governors of gravity type-effort and power-controlling force diagram-quality of governors-effect of friction-insensitiveness-stability-inertia governors- governor speed, torque characteristics of an engine-governor and flywheel.

Module III (12 hours)

Turning moment diagram and Flywheel: - coefficient of fluctuation of energy and speed- energy saved in a flywheel-punching press-dynamically equivalent two mass system-centre of percussion-kinetic equivalence-reversed effective force analysis-piston effort-crankpin effort- crank effort-turning moment diagrams for I.C. engines.

Module IV (10 hours)

Gyroscope: - Principle-Angular acceleration-Effect of gyroscopic couple on bearings, airplanes, and ships-stability of automobile and two wheel vehicles-Gyroscopic stabilization of sea vessels and grinding mills-Rigid disc at an angle fixed to a rotating shaft

Module V (12 hours)

Brakes and clutches: Shoe, double block, long shoe, internally expanding shoe, band, band & block, hydraulic, mechanical, air and power brakes-braking of a vehicle-cone, single plate, multiple, centrifugal clutches.
Dynamometers: Pony brake. rope brake, epicyclic train, belt transmission and torsion dynamometers-effort and power.

Reference Books

1. R L Norton, Kinematics and Dynamics of Machinery, 1^{st} ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
2. J. E. Shigley, J. J. Uicker, *Theory of Machines and Mechanisms*, McGraw Hill
3 S .S Rattan Theory of Machines, 3^{rd} ed., *Tata McGraw Hill Education Private Limited*, Delhi, 2009
4 A. Ghosh, A. K. Malik, *Theory of Mechanisms and Machines*, Affiliated East West Press
5. C. E. Wilson, P. Sadler, *Kinematics and Dynamics of Machinery*, 3^{rd} edition, Pearson Education.
6. Holowenko, Dynamics of Machinery, John Wiley

ME010602: Heat and Mass Transfer

(Common with AU010 602)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To provide a useful foundation and basic knowledge of the subject required for innovative work and advanced studies.*
- *To motivate the students and to develop interest in the subject by providing information along with practical application of different formulae from an engineering point of view.*

Module I (12 hours)

Scope and application of heat transfer principles in engineering practice. Introduction to basic modes of heat transfer

Conduction: Fourier law-thermal conductivity of solids, liquids and gasses-factors affecting thermal conductivity-common conducting and insulating materials. General heat conduction equation in Cartesian, cylindrical and spherical co-ordinates- one dimensional steady state conduction with and without heat generation-conduction through homogeneous and composite surfaces-plane wall, cylinders and spheres-concept of thermal resistance-contact resistance-variable thermal conductivity-critical thickness of insulation-overall heat transfer coefficient-heat transfer through corners and edges-conduction shape factor.

Module II (12 hours)

Convection: Elementary ideas of hydrodynamic and thermal boundary layers-Newton's law of cooling-factors affecting heat transfer coefficient in forced and natural (free) convection heat transfer-application of dimensional analysis to free and forced convection-significance of Prandtil number, Reynold's number, Grashof number and Nusselt number. Forced convection: Laminar and turbulent flow heat transfer in a circular pipe- Laminar and turbulent flow heat transfer in flow over a flat plate-flow across a cylinder. Natural convection: Natural convection heat transfer from a plate kept vertical and horizontal- cylinder kept vertical and horizontal-description of natural convection heat transfer from enclosed spaces. (Problems limited to using important empirical relations available in data book)

Module III (12 hours)

Heat transfer from extended surfaces: Governing equation and boundary conditions-straight rectangular fin-pin fin of uniform cross sectional area-circumferential fin-fin effectiveness-fin efficiency-solving problems using data book.

Heat exchangers: General classification of heat exchangers according to type of energy transfer, according to flow arrangement and according to area to volume ratio-Log Mean Temperature Difference (LMTD) for parallel flow, counter flow and cross flow arrangements-calculation of heat exchanger size and flow rates from known temperatures. Effectiveness_NTU method of evaluation-solving problems using data book.

Module IV (12 hours)

Radiation: Nature of thermal radiation-definitions and concepts-monochromatic and total emissive power-absorptivity, reflectivity and transmissivity-definition of black, grey and real surfaces-concept of a black body-Plank's law, Kirchoff's law, Wein's displacement law and Stefan-Boltzmann law-geometric factor (shape factor or configuration factor) of simple geometries. Heat exchange by radiation between black surfaces of equal, parallel and opposite black squares and discs-black rectangles perpendicular to each other having a common edge-heat exchange between infinite parallel planes of different emissivity-radiation shield (no derivation)-simple derivations and simple problems using data book.

Module V (12 hours)
Mass Transfer: Introduction to mass transfer-Fick's law of diffusion-steady state mass diffusion of gasses and liquids through solids-convective mass transfer (elementary concepts and definitions)-analogy between heat and mass transfer-elementary problems.
Condensation and boiling: Laminar film condensation on a vertical plate and horizontal tubes.
Pool boiling-different regimes of pool boiling-flow patterns in flow boiling in a vertical tube.
Two dimensional steady state heat conduction-governing equation and boundary conditions-application of finite difference method in solving two dimensional steady state heat conduction through a rectangular slab (method of discretisation of nodal equations only)
Data Book:

1. C. P. Kothandaraman, S. Subramanyan, *Heat and Mass Transfer Data Book*, 5th ed., New Age International Publishers.
2. A. V. Domkundwar, Dr. V. M. Domkundwar, *Heat and Mass Transfer Data Book*, 3rd ed., Danapat Rai & Co.

References:

Text Books

1. S. P. Sukhatme, *A Text Book on Heat Transfer*, 4th ed.,Universities Press, Hydrabad, 2005
2. S. K. Som, *Introduction to Heat Transfer*, PHI Learning pvt.ltd,New Delhi, 2008
3. P. K. Nag, *Heat Transfer*, 1st ed., Tata McGraw-Hill

Reference Books

1. Frank P. Incropera, David P. Dewitt, *Fundementals of Heat and Mass Transfer,* 5th ed., John Wiley & Sons
2. J. P. Holman, *Heat Transfer*, 9th ed., Tata McGraw Hill Education pvt.ltd., New Delhi, 2010
3. M. Necati Ozisick, *Heat Transfer A Basic Approach*, McGraw Hill Book Company
4. Frank Kreith, Mark S. Bohn, *Principles of Heat Transfer*, 5th ed , PWS Publishing Company
5. S. P. Venkateshan, *A First Course in Heat Transfer*, Ane Books, Chennai

ME010 603 Thermal Systems and Applications

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of different types of engines*
- *To develop an idea about various thermal systems..*

Module I (12 hours) Steam Engineering: Properties of steam - wet, dry and superheated steam - dryness fraction - enthalpy and internal energy - entropy of steam - temperature entropy diagram - process - Mollier chart - Rankine cycle for wet, dry and superheated steam. Steam Generators - classification - modern steam generators - boiler mountings and accessories.

Module II (12 hours) Steam nozzles - Mass flow rate - throat pressure for maximum discharge - throat area - effect of friction - super saturated flow.
Steam turbines: velocity triangles, work done, governing, and efficiencies.

Module III (12 hours) Gas turbine Plants - Open and closed cycles - thermodynamics cycles - regeneration, re heating - inter cooling - efficiency and performance of gas turbines. Rotary Compressors - Analysis of rotary compressors - centrifugal and axial compressors and reciprocating compressors. Combustion - combustion chambers of gas turbines - cylindrical, annular and industrial type combustion chamber - combustion intensity - combustion chambers efficiency - pressure loss combustion process and stability loop.

Module IV (12 hours) Introduction to solar energy - solar collectors - Liquid flat plate collectors - principle - thermal losses and efficiency - characteristics - overall loss coefficient - thermal analysis - useful heat gained by fluid - mean plate temperature - performance - focussing type solar collectors - solar concentrators and receivers - sun tracking system - characteristics - optical losses - thermal performance - solar pond - solar water heating - solar thermal power generation (Description Only)

Module V (12 hours) Thermal power plants: layout and operation of steam and diesel power plants - coal burners - stockers - cooling ponds & towers - chimneys - draught - dust collectors - precipitators - feed water heaters - evaporators - steam condensers - coal handling - ash handling.

Text Books

1. E. L. Wahid , *Power plant technology*
2. Mathur and Mehta, *Thermodynamic and heat power engineering*, Jain Brothers.
3. P. L. Ballaney , *Thermal Engineering*, Khanna publishers

Reference Books

1. Cohen & Rogers, *Gas Turbine Theory*
2. G. D. Rai, *Solar Energy Utilization*
3. R.K. Rajput, *Thermal engineering*, Lakshmi publications

ME010 604: Metrology and Machine Tools

(Common with AU010 604)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *Understand and appreciate the importance of basic principles of traditional material removal processes.*
- *Understand the application of those principles in practice.*
- *To understand the principles of metrology and measurements, methods of measurement and its application in manufacturing industries.*

Module I (12 hours)

Conventional Machining Processes Turning machines:- Types - method of holding work and tool, accessories, attachments-operations and types of tools for each operation - tool room lathe - duplicating lathe - Capstan and Turret lathe – knurling - Drilling:- types of drilling machines - types of drills - nomenclature of drill point - drill wear - types of chip breakers - cutting forces in drilling - Boring:- types of boring machines, tool geometry - counterboring, spot facing, countersinking, trepanning – Reaming:- types of reamers - tool nomenclature - cutting forces - tool materials and surface roughness obtainable in each operations.
Shaping, planing and slotting machines:- Types and specifications - quick return motion - hydraulic feed and its advantages - automatic feed-speed, feed and depth of cut -work holding devices - types of operation and examples of work done - shaping of V-blocks, planing of guide gibs, slotting of keyways – Broaching:- - basic process - different cutting elements – force required for broaching and strength of broach – tool materials and surface roughness obtainable in each operations.

Module II (12 hours)

Milling operations:- different types milling machines - Different methods of milling - nomenclature of milling cutters – cutting forces in milling – different types of milling cutters – attachments for milling:-vertical milling and universal milling attachment, high speed milling attachment, rack milling and slot attachments, parking bracket, rotary table, universal dividing head, vices, arbors, adaptors and collet chucks – tool materials and surface roughness obtainable in milling – machining centers: applications and advantages - Grinding: - types of machines - Grinding mechanisms:- grinding debris, grinding force power, specific energy - Grinding wheels:- different types of abrasives, grain size, different types of bond, grade, structure – marking system of grinding wheels - Grinding fluids – Truing and dressing of grinding wheels - Grinding temperature, thermal damage and surface roughness obtainable. Horning: Types of machines, methods of honing – types honing stones – honing conditions - cutting fluids - surface roughness obtainable - Lapping: - types of hand lapping - types of lapping machines - surface roughness obtainable – Burnishing:- processes and surface roughness obtainable.

Module III (12 hours)

Gear cutting process: - Gear milling: - gear milling machines and different gear milling operations - Gear hobbing: - principle of the hobbing process and hobbing machines, basic types of hobbing machines, different hobbing techniques, nomenclature of hob, hob wear, spur gear hobbing, helical gear hobbing - gear shaping: - principle of gear shaping process - gear finishing - gear errors - Thread production process: - different thread production processes: screw cutting on lathe, thread milling, thread whirling, die threading, tapping, thread rolling, and thread grinding.

Module IV (12 hours)
Engineering Metrology
General measurements concepts:- Principles for achieving accuracy; methods for estimating accuracy and precision, precision Vs accuracy, systematic and constant errors; progressive, random, erratic, drunken errors - Fits and tolerances:- types of fits: hole and shaft basis system – limit gauges:- gauge tolerance, presentation of gauge tolerances – Taylor's theory of gauging – limit gauges for screw threads - Design and operation of linear measurements:- Principle of alignment (Abbe's), accuracy and precision etc. – Principle of kinematics: complete constraints, one degree of freedom – Gauge blocks:- gauge materials, accuracy and standards, effect of temperature, surface roughness and manufacturing of gauge blocks – Comparators:- mechanical, mechanical-optical, pneumatic and horizontal length comparator – Angle measurements:- three disc, sine bar and dial gauge – measurement of taper plug ring gauges and taper bores – Precision levels, clinometer – Optical instruments for angle measurements:- optical principles of projector, microscope, telescope, collimator, auto collimator - optical flat and optical parallel applications – auto collimator, angle dekkor, combination of angle gauges, optical flat.

Module V (12 hours)
Tool makers microscope – profile projector – optical microscope, SEM and TEM - straight edge – surface plate – measurement of squareness:- squareness testing with dial gauge, tilting bar, optical square, checking an internal right angle - Measurement of surface roughness: meaning of surface texture and causes – stylus probe instrument, RMS, CLA, peak to valley, R_a, R_t, R_z etc. – stylus, skid, effect of sampling length, magnification, cut-off, evaluation length etc. – comparison of surface roughness of different machining process – concept of apparent to real area of contact of mating surfaces, applications in clutch plate surface, brake liner, inner race of a bearing, cylinder liner, machine tool guide way, significance of surface roughness in crack initiation – assessment of roundness errors:- least square reference circle, minimum circumscribed circle, minimum zone reference circle and maximum inscribed circle – roundness parameters:- eccentricity, concentricity and runout – three wire system of thread pitch diameter measurement - gear tooth measurement by vernier caliper, pin method of measuring gear teeth – Alignment tests for machine tools:- test for level installation of a lathe bed – spindle tests of concentricity and alignment with guide ways – tests for straightness and flatness of a lathe bed guide ways – test for squreness of a drilling machine spindle with table – CMM, laser interferomerty and applications.

Text Books

1. S. Haykin and B. V. Veen, *Signals and Systems*, John Wiley & Sons, N. Y., 2002
2. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, *Signals & Systems*, 2nd ed., Prentice Hall of India, New Delhi, 1997

Reference Books

1. C. L. Philips, J. M. Parr, E. A Riskin, *Signals, Systems and Transforms*, 3rd ed., Pearson Education, Delhi, 2002
2. R. E. Zeimer, W. H. Tranter, and D. R. Fannin, *Signals and Systems: Continuous and Discrete*, 4th ed., Pearson Education, Delhi, 1998
3. M. J. Roberts, *Signals and Systems: Analysis using Transform methods and MATLAB*, Tata McGraw Hill, New Delhi, 2003

ME010 605 Mechatronics and Control systems

(Common with AU010 605)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart basic concepts of mechatronics and control systems.*

Module 1 [12 Hours]

Introduction:-Scope of Mechatronics-Systems-Microprocessor based controllers-mechatronic approach-sensors-transducers-force-velocity-displacement-temperature-inputting data by switches-signal conditioning-operational amplifiers-filtering-multiplexers-data acquisition-modulation. Data presentation systems:- Displays-measurement systems-calibration-pneumatic and hydraulic systems-control valves-actuators-mechanical and electrical activation systems-relays and solenoid switches-proximity pickups.

Module 2 [12 Hours]

Input/output Systems:-Ports, interface requirements, adaptors-programmable logic controllers-data handling digital communications-system, networks, protocols, interfaces, fault finding- design and mechatronic design solutions. Electromechanical systems:-CD, DVD Rom, OCR, Printers.

Module 3 [12 Hours]

Introduction to Control Systems Engineering:-Concept of automatic control-open loop and closed loop systems-servomechanisms-Block diagrams-transfer functions-Representation of control components and systems-Translational and rotational mechanical components –series and parallel combinations-comparators ,integrating devices, hydraulic servomotors, temperature control systems, speed control systems.

Module 4 [12 Hours]

System Response:-First and second order system-Response to step, pulse, ramp and sinusoidal input-systems with distance, velocity lag. Control System Analysis:-Transient Response of simple control systems –Stability of control systems –Routh Stability criteria –Error Analysis.

Module 5 [12 Hours]

Frequency Response Analysis :- Polar ,Rectangular and Logarithmic plots –Experimental determination of frequency response -Bode and Nyquist stability criteria – Gain and phase margin. Root locus of simple transfer function.

Text Books

1. Mechatronics-W.Bolton-Pearson
2. Control Systems- A. Nagoor Kani

References

1. Mechatronics-A.Smaili&F.Mrad-Oxford
2. Control Systems Engg –T .J. Nagrath & M .Gopal.
3. Automatic Control Theory-Ravan.
4. Modern Control Engg.-K. Ogatta
5. Control Systems Engg -Benjamin C Kuo

ME010 606L01 Computational Fluid Dynamics

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To introduce the primary components of learning and practicing CFD*
- *To develop an understanding of solution methods for fluid motion and energy transfer equations*

Module 1 (15 hours)
Basic concepts: conservation principles – derivation of transport equations: control volume – Langangian and Eulerian approach- mass conservation equation-momentum conservation equations-stress laws-mass transfer equation-energy equation-rate change-convection and conduction-volumetric generation-work done by surface and body forces- dimensionless form of Navier-Stokes equations- introduction to numerical methods, advantages and limitations.

Module 2 (10 hours)
One dimenensional conduction: The governing equation- grid layout-discretisation-stability and convergence-explicit, implicit and semi-implicit procedures-methods to handle non-linearities- Solution methods-Gauss-Siedel method and TDMA-Simple problems.

Module 3 (10 hours)
One dimensional conduction-convection: exact solution-discretisation- central difference scheme-upwind difference schemes- numerical false diffusion-stability of unsteady equation-exact solution-explicit finite difference form-implicit finite difference form.

Module 4 (10 hours)
Two dimensional boundary layers: governing equations- descretisation method- symmetry, wall and free stream boundary conditions- dealing with source terms –defining initial conditions-choice of grid size and iterations-applications (excluding turbulence)

Module 5 (15 hours)
Two dimensional Convection-Cartesian Grids: simple mathematical models for incompressible, in viscid, potential and creeping flows-approximations of hyperbolic, parabolic, elliptic, and mixed flows. Solution strategies for 2D convection problems- SIMPLE algorithm-descretisation- pressure correction equation- solution procedure- Solution methods: iterative solvers-evaluation of residuals-under relaxation-boundary conditions - simple description on treatment of turbulent flows - applications (laminar flows only).

Text Books

1. Anderson J.D., *Computational Fluid Dynamics*, McGraw- Hill Co.
2. Joel H. Ferzigerand Peric M., *Computational methods for Fluid Dynamics*, Springer Werlag Publishers

Reference Books

1. Patankar S.V., *Numerical Fluid Flow and Heat Transfer* , Hemisphere, New York
2. Anil W. Date, *Introduction to Computational Fluid Dynamics*, Cambridge University Press
3. Hiderbrand F.B., *Introduction to Numerical Analysis* , Tata McGraw- Hill

ME010 606 L02: Composite Materials Technology

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives: To understand the concept of composite materials

Module I (12 hours)

Fibers**:** introduction – glass fibers: fabrication, structure, properties and applications – Boron fibers: fabrication, structure, morphology, properties and application – Carbon fibers: Different preparation methods, structural change during preparation, properties and application – Aramid fibers: fabrication, structure, properties and applications – Ceramic fibers: Alumina and silicon carbide fibers – metallic fibers.

Module II (12 hours)

Matrix materials: Polymers and its characteristics – Metals: fiber reinforcement of metals **-** Ceramic matrix materials: bonding and structure, effect of flaws on strength and common ceramic matrix materials.

Interfaces**:** wettability and bonding interface in composites – types of bonding at interface – tests for interfacial strength.

Module III (12 hours)

Metal Matrix Composites (MMC)**:-** Different fabrication methods of MMC – interface in MMC – discontinues reinforcement of MMC – detailed discussion on mechanical properties – applications.

Module IV (12 hours)

Ceramic Matrix Composites (CMC)**:-** Different fabrication methods of CMC – interface in CMC – detailed discussion on properties – toughness of CMC **-** applications.

Carbon fiber composites: fabrication – properties – interface.

Module V (12 hours)

Micromechanics of composites: Maximum stress and strain criterion, Tsai-Hill and Tsai-Wu failure criterion (derivations) **-** mechanics of load transfer from matrix to fiber (description only).

Polymer matrix composites**:** properties and engineering applications **–** processing of PMC: hand lay-up, spray up, compression molding, reinforced reaction injection molding, resin transfer molding, pultrusion, filament winding, injection, vacuum bag molding process.

Text Books

1. S. Haykin and B. V. Veen, *Signals and Systems*, John Wiley & Sons, N. Y., 2002
2. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, *Signals & Systems*, 2nd ed., Prentice Hall of India, New Delhi, 1997

Reference Books

1. C. L. Philips, J. M. Parr, E. A Riskin, *Signals, Systems and Transforms,* 3rd ed., Pearson Education, Delhi, 2002
2. R. E. Zeimer, W. H. Tranter, and D. R. Fannin, *Signals and Systems: Continuous and Discrete,* 4th ed., Pearson Education, Delhi, 1998
3. M. J. Roberts, *Signals and Systems: Analysis using Transform methods and MATLAB,* Tata McGraw Hill, New Delhi, 2003

ME010 606L03: AUTOMOBILE ENGINEERING

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of Automobile parts and its working*
- *To develop an idea about the fundamentals on modern vehicle technologies.*

Module 1 (12 hours)

Engines: Types of engines in automobiles-classifications-engine components-working of various systems-present and future vehicles, engine construction- intake and exhaust systems. Different combustion chambers, carburetors, diesel fuel pumps, injectors, single point and multi point fuel injection-MPFI and CRDI systems -lubricating and cooling systems.
Vehicle performance-resistance to the motion of vehicle-air, rolling, and radiant resistance-power requirement-acceleration and gradeability-selection of gear ratios.

Module 2 (12 hours)

Transmission: prime movers- clutch-principle of friction and cone clutches –centrifugal clutches, diaphragm clutches and fluid couplings-Gear box-necessity and principle. Constant mesh, sliding mesh, synchromesh gear boxes and epicyclic gearbox –overdrives. Hydraulic torque converters-semi and automatic transmission systems - constant velocity and universal joints. Final drive-front wheel, rear wheel and four wheel drives-transfer case-Hotchkiss and torque tube drives-differential-non-slip differential-rear axles-types of rear axles.

Module 3 (12 hours)

Steering and Suspension: Different steering mechanisms- Ackermann Steering mechanism. Steering gear boxes- power steering –types. Suspension systems-front axle, rigid axle and independent suspensions-anti-roll bar-coil spring and leaf spring -torsion bar -Macpherson strut- sliding pillar- wish bone- trailing arm suspensions-Shock absorbers -hydraulic and gas charged shock absorbers-air suspensions
Front axle types-front wheel geometry-castor, camber, king pin inclination, toe-in toe-out , wheel balancing- wheel alignment.
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Module 4 (12 hours)

Chassis, Brakes and Tyres: Types of chassis and body constructions-crumble zones, air bags and impact beams. Braking mechanism and convectional brakes- Drum brakes and Disc brakes. Vacuum booster, hydraulic and power brakes, components and attachments of mechanical, hydraulic and pneumatic brakes-Master cylinder-Tandem cylinder- working. Anti-lock braking systems-Wheels and Tyres- tubeless tyres-ply ratings- radial tyres. Different tyre wears- causes

Module 5 (12 hours)

Electrical systems - Battery ignition system circuit- electronic ignition system alternators - voltage regulators starting system- bendix and follow through drives –automotive lighting, accessories and dashboard instruments- head light and horn with relays-circuit diagrams. Automotive air conditioning Preventive and breakdown maintenance- engine testing, servicing-engine overhaul- engine tuning.

Text Books

1. Kripal Singh , *Automobile Engineering (Vol. 1 & 2)*
2. V.A.W Hillier & Peter Coombes, *Hillier's Fundamentals of Motor Vehicle Technology*. New Age International.

Reference Books

1. K.M.Guptha , *Automobile Engineering (Vol. 1 & 2)*
2. Joseph Heitner, *Automotive Mechanics*
3. Harbans Singh Reyd, *Automobile Engineering*
4. William H. Course, *Automotive Mechanics*

ME010 606L04:Advanced Strength of Materials

(Common with PE 010 606L05)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To analyse the stresses and deformations through advanced mathematical models.*
- *To estimate the design strength of various industrial equipments.*

Module 1 (12 -hours)

ANALYSIS OF PLATES Mathematical modeling of plates with normal loads – Point and Distributed Loads – Support conditions – Rectangular plates - Stresses along coordinate axes – Plate deformations – Axi-symmetric plates – Radial and tangential stresses – plate deflections.

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Module II (14-hours)

THICK CYLINDERS AND SPHERES Equilibrium and compatibility conditions - Lame's Theorem – Boundary conditions – distribution of radial and tangential stresses – compound cylinders – Interference fits - Stresses due to temperature distributions. piston, oscillating motor-characteristics.

Module III (12 -hours)

ROTATING DISCS Lame-Clayperon Theorem – radial and tangential stresses in discs due to centrifugal effects – boundary conditions – solid and hollow discs – Interference fit on shafts –Strengthening of the hub – residual stresses – Autofrettege – Discs of variable thickness – Disc profile for uniform strength.

Module IV (12 - hours)

BEAMS ON ELASTIC FOUNDATION Infinite beam subjected to concentrated load – Boundary Conditions – Infinite beam subjected to a distributed load segment – Triangular load – Semi infinite beam subjected to loads at the ends and concentrated load near the ends – Short beams.

Module V (10 - hours)

CURVED BEAMS AND CONTACT STRESSES Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps – Contact Stresses – Hertz equation for contact stresses – applications to rolling contact elements.

Text Books

1. Boresi A.P., Schmidt R.J., "Advanced Mechanics of Materials", John Wiley and Sons, Sixth edition, 2003.
2. Dally J.W. and Riley W.F, "Experimental Stress Analysis", John Wiley and Sons 2003

Reference Books

1. Burr A. H., CheathAm J.B., "Mechanical Analysis and Design", Prentice Hall of India, Second edition, 2001.
2. Den-Hartog J.P., "Strength of Materials", John Wiley and Sons..

ME010 606L05: Industrial Hydraulics

(Common with PE 010 606L05)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of Fluid properties, hydraulic machines and pumping machinery*
- *To develop an idea about pressure measurements working and properties of hydraulic machines and various types of pumping machineries.*

Module 1 (14 -hours) Introduction to hydraulic / pneumatic devices. Symbols and nomenclature. Power transmission, Hydraulic pumps-classifications, characteristic **C**omparison of electric, hydraulic and pneumatic devices. Hydraulic accumulators.

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Module II (14-hours) Pumps and motors: Principle of working. Hand pumps-single acting, double acting, multi- displacement. Gear pumps- internal, external and gear ring. Screw, vane, piston pumps – axial piston pump, swash pump, bent axis pump radial and series pumps. Types of hydraulic motors, gear motors, vane motors, piston motors- radial piston, rolling vane, ball piston, oscillating motor-characteristics. Telescopic cylinder, cylinder cushion**.**

Module III (12 -hours) Hydraulic valves: Directional control valve, shuttle valve, pressure control valve Stop valve- non return valve-relief valve-sequence valve-counter balance valve- pressure reducing valve – flow control valve –direction control valves- throttling, non throttling- open centre and closed centre and tandem centre valves- their principle of operation.

Module IV (12 - hours) Hydraulic Circuits and Circuit fundamentals. Flow divider and combiner. Piping terminology, control terminology, flow control of hydraulic pump, velocity control- characteristics. Different types of switching and its merits Meter in and meter out. Applications of unloading valve. Application of pressure reducing and pressure sequence valve.

Module V (8 - hours) Properties of commonly used hydraulic fluids-Typical hydraulic circuits used in machine tools –Rivetter- pneumatic Hammer, hydraulic press, and power steering

Text Books

1. S.R.Majumdar, *Oil Hydraulics and Systems-Principles and maintenance*, TMH
2. John Pippenger & Tyler Hicks - *Industrial Hydraulics*

Reference Books

1. Daniel Bonteille -*Fluid Logic and Industrial automation*.
2. Pneumatic Systems –*Principles and Maintanance by S.R Majumdar*, TMH
3. Esposito- *Fluid power with applications*.

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ME010606 L06 Project Management

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of Project selection.*
- *To develop an understanding of tools, techniques and software available for Project Management.*

Module 1 (10 hours)
Introduction, Capital Investments, Phases of Capital Budgeting, Project Characteristics, Taxonomy of Projects, Project Identification and Formulation. 7-S of Project Management. Project feasibility Analysis- Market and Demand Analysis, Technical Analysis, Financial Analysis, Ecological Analysis, Social Cost Benefit Analysis.

Module 2 (15 hours)
Cost of the Project, Means of Finance, Financial Evaluation of projects- Pay back period method, Accounting Rate of Return method, Net Present Value method, Internal Rate of Return method, Benefit Cost Ratio method, etc., Simple Problems.

Module 3 (10 hours)
Risk Analysis-risk in economic analysis-measuring risk in investment; Sources, Measures and Perspectives on Risk, Techniques used for risk analysis – Decision trees, Simulation, Break-even Analysis etc., Techniques for Managing Risk.

Module 4 (15 hours)
Project Scheduling- PERT and CPM techniques, Estimates -time, cost, resources (man, material, tool), Crashing of Projects, Project scheduling with constrained resources, resource leveling, resource Allocation.

Module 5 (10hours)
Computer Aided Project management, Essential Requirement of Project Management Software, MS Project 2010 software, Features and Facilities in Project 2010, Types of Reports available in Project 2010 etc. Project Management Information Systems (PMIS), PMIS sotware, Web- Enabled Project Management.

Text Books

1. Prasanna Chandra, *Projects*, Tata McGraw Hill.
2. Nagarajan K, *Project Management 4th edition*, New Age International (P) Ltd.

Reference Books

1. Nicholas J. M. & Steyn H., *Project Management*, Elsevier.
2. Brian Kennemer and Sonia Atchison, *Using Microsoft Project 2010*, Que Publishing.
3. Harvey Maylor, *Project Management*, Pearson Education.
4. Panneerselvam & Senthilkumar, *Project Management*, PHI

ME010 607: HEAT ENGINES LABORATORY

(Common with AU010 607 and AN010 607)

Teaching scheme **Credits:** 2
3 hours practical per week

Objectives

- *To provide experience on testing of IC engines performance.*

Study of systems and components of IC Engines and automobiles - study of dynamometers used in engine testing - study of IC Engine repairs and maintenance.

Study of boilers, boiler mountings and accessories - study of steam engine parts and systems.

Testing of IC engines • Performance analysis of IC engine using computerized test rig-
Load test on petrol and diesel engines- determination of indicated and brake thermal efficiencies - mechanical efficiency - relative efficiency - volumetric efficiency - air-fuel ratio and compression ratio - valve timing diagram - retardation test - Morse test - heat balance - effect of varying the rate of cooling water and varying the speed on the performance characteristics of engines.

Testing of steam boiler - boiler trial - steam calorimeters and steam nozzles - performance test on steam engines - performance test on steam turbines.

Testing of fuels and lubricants - determination of flash and fire points of petroleum products - determination of kinematics and absolute viscosity of lubricating oils - determination of calorific values

Internal Continuous Assessment *(Maximum Marks-50)*

50%-Laboratory practical and record
30%- Test/s
20%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
30% - Viva voce

ME010 608 Machine Tool Laboratory

(Common with AU010 608)

Teaching scheme **Credits:** 2

3 hours practical per week

List of Experiments

1. Study of precision tools used in machine tool laboratory: – Vernier caliper, micrometers, surface plates, surface gauges, gauge block, straight edges, dial gauge, plug and ring gauges, slip gauges, sine bar, care of tools and gauges. **– 2 practices**.
2. Study of lathe tools and accessories: - Selection of tool for different operations - tool materials: high carbon steel, HSS, cemented carbides, coated WC, indexable inserts, alumina, cBN, diamond etc. - tool nomenclature and attributes of each tool angles on cutting processes – effect of nose radius, side cutting edge angle, end cutting edge angle and feed on surface roughness – tool grinding and safe working practices. - 1 **practice.**
3. Selection of speeds, feeds and depth of cut – selection of cutting fluids – different methods of holding work. **- 1 practice.**
4. Experiment on arc and gas welding: - butt welding and lap welding of M.S. sheets. **- 1 practice.**
5. (a) Measurement of cutting forces in turning process using dynamometers. (b) Experiment on lathe:- Facing, plain turning, step turning and parting - groove cutting, knurling and chamfering - form turning and taper turning - eccentric turning.
   (c) Measurement of flank wear in turning process using tool makers microscope. **- 3 practices.**
6. Experiment on thread cutting: - single and multistart external and internal threads, square and V-threads. **- 1 practice.**
7. Disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc. **- 1 practice.**
8. Experiment on drilling machine: - drilling, boring, reaming and counter sinking – taping – study of reamers and taping. **- 1 practice**.
9. Study and demonstration of N.C. machines:- CNC machines components - Point to point, straight cut and contouring positioning - incremental and absolute systems – open loop and closed loop systems – DDA integrator and interpolators - part programming fundamentals - manual programming – tape format – sequence number, preparatory functions, dimension words, speed word, feed world, tool world, miscellaneous functions – Computer aided part programming:- APT language structure: geometry commands, motion commands, postprocessor commands, compilation control commands – programming, simulation and demonstration exercises involving plane taper and form turning etc. - **3 practices.**

Besides to the skill development in performing the work, prepare the control charts and oral examination should also be carried out. Observation and record books are to be maintained.

The student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and University examination shall be carried out by the faculty members (lecturer and above).

TEXT BOOKS:

1. Acharkan. N., Machine Tool Design Vol. 1 to 4, MIR Publication.

REFERENCE BOOKS:

1. Chapman, Workshop Technology, Vol II, ELBS.
2. HMT, Production Technology, Tata McGraw Hill.
3. Yoram Koren, Numerical Control of Machine Tools, McGraw-Hill.

ME 010 701 Design of Machine Elements

(Common with AU010 701)

Teaching scheme **Credits:** 4

2 hours lecture, 1 hour tutorial and 1 hour drawing per week

Objectives

To provide basic knowledge on the design considerations and methodology of various machine elements.

Module I (15 Hrs)

System design cycle - Different phases in design process - design factors and considerations - tolerances and fits - Hole basis & Shaft basis system - standardization - selection of materials - stress concentration - Methods to reduce stress concentration - theoretical stress concentration factor - theories of failure - Guest's theory - Rankine's theory - St. Venant's theory - Haigh's theory - Von Mises & Hencky theory - shock and impact loads - fatigue loading - endurance limit stress- Factors affecting endurance limit - Factor of safety - creep and thermal stresses.

Module II (15 Hrs)

Design of riveted joints- Failure of riveted joints and efficiency of joint -boiler and tank joints- structural joints, Cotter and Knuckle joints

Threaded joints - thread standards- thread nomenclature - stresses in screw threads- bolted joints preloading of bolts- eccentric loading- fatigue loading of bolts - Power screws.

Module III (15 Hrs)

Design of welded joints- Representation of welds - stresses in fillet and butt welds- design for static loads - bending and torsion in welded joints- eccentrically loaded welds - design of welds for variable loads.

Springs- stresses and deflection of helical springs with axial loading - curvature effect - resilience - design of spring for static and fatigue loading- surging- critical frequency- stress analysis and design of leaf springs..

Module IV (15 Hrs)

Shafts and axles design- stresses- causes of failure in shafts - design based on strength, rigidity and critical speed- design for static and fatigue loads- repeated loading- reversed bending-

Design of couplings - Rigid and flexible couplings - design of keys and pins.

Note: Any one of the following data book is only permitted for reference in the University examination

1. Machine Design Data hand book by K. Lingaiah, Suma Publishers, Bangalore/ Tata Mc Graw Hill
2. PSG Design Data, DPV Printers, Coimbatore.

Text Books

1. C.S, Sarma, Kamlesh Purohit, Design of Machine Elements, Prentice Hall of India Ltd , New Delhi
2. M. F. Spotts, T. E. Shoup, Design of Machine Elements, Pearson Education.
3. V.B. Bhandari, Design of Machine Elements, McGraw Hill Book Company

Reference Books

1. J. E. Shigley, Mechanical Engineering Design, McGraw Hill Book Company

ME 010 702: Dynamics of Machines

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the basic principles involved in the balancing of rotating and reciprocating masses*
- *To understand the basic concepts of vibration of single degree of freedom systems*
- *To understand the methods of analysis of two degree and multi degree of freedom systems.*
- *To understand the concepts in transient and non linear vibration*
- *To understand the methods of noise control*

Module I (14 hours)

Balancing: - Balancing of rotating masses, static balancing and dynamic balancing, Balancing of several masses rotates in same plane, balancing of several masses rotating in several planes, Balancing machines.

Balancing of reciprocating masses: - The effect of inertia force of the reciprocating mass on the engine. Partial primary balance. Balancing of multi cylinder inline engines, v-engines, Radial engines, Direct and Reverse cranks

Module II (16 hours)

Vibrations: - Definitions, simple harmonic motion. Single degree freedom systems: -

Undamped free vibrations: - Equations of motion Natural frequency, Energy method, Equilibrium methods, Rayleigh’s methods, Equivalent stiffness of spring combinations.

Damped free vibrations: - Viscous damping, Free vibrations with viscous damping, Over damped system, Critically damped system, Under-damped system, Logarithmic decrement, viscous dampers, Energy dissipated by damping,

Forced Vibrations: - Forced harmonic excitation, Base Excitation, Vibration isolation and Transmissibility. Vibration measuring instruments.

Module III (14 hours)

Two degree freedom systems: - Principal modes of vibration, Rectilinear and angular modes, systems with damping, vibration absorbers, Centrifugal pendulum damper, Dry friction damper, untuned viscous damper.

Multi-degree of freedom system: - Free vibrations, equations of motion, Influence Coefficients method, lumped mass systems, distributed mass systems (basics only), Stodola method, Dunkerly’s method.

Torsional Vibrations: - Torsionally equivalent shaft, torsional vibration of two rotor, three-rotor, and geared systems

Module IV (14 hours)

Critical speeds of shafts: - Critical speed of a light shaft is having a single disc without damping.

Transient vibration: - Laplace transformation, response to an impulsive input, response to a step input, phase plane method, shock spectrum.

Non-linear vibrations: - Phase plane, undamped free vibration with non-linear spring forces, hard spring, soft spring, Forced vibration with nonlinear forces, Duffings equation, self excited vibrations - problems.

Module V (12 hours)

Acoustics: - Sound propagation, decibels, acceptance noise levels, Air columns, acoustical measurements, Doppler Effect, microphones and loud Speakers. Recording and reproduction of sound, Fourier's theorem and musical scale, Acoustic impedence filters.

Environmental noise control: Industrial noise control strategies Noise ratings, human ear. human tolerance levels, equivalent sound level and loudness contours - Noise control through barriers and enclosures and absorbent linings - problems.

References

1. Theory of Machines - Thomas Bevan
2. Theory of Machines - P.L. Ballaney
3. Mechanical Vibrations, V edition - G.K. Groover
4. Theory of Vibrations with applications, III Edn - W.T. Thomson
5. Mechanical Vibrations - S. Graham Kelly, Schaum's outlines
6. Fundamentals of Vibrations - Leonard Meirovitch, Mac Graw Hill
7. A text book of sound - L.P. Sharma & H.C. Saxena
8. Engineering Noise Control - D.A. Bies & C.H. Hausen.
9. Noise & Vibration Control - Leo N. Beraneck

ME 010 703: Gas Dynamics and Jet Propulsion

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of dynamics and thermodynamics of gas flow.*

Module I (7 hours)

Introduction: Continuum- Control Volume and System approaches- Continuity and Momentum equations for control volume- Mach number- Velocity of sound- Classification of flow based on Mach number- Physical difference between incompressible, subsonic and supersonic flow- Mach angle- Karman's rule of supersonic flow- Effect of Mach number on compressibility- General features of one dimensional flow of compressible fluid.

Module II (10 hours)

Isentropic flow of an ideal gas: General features and governing equations- stagnation properties and state- Reference velocities- Dimensionless velocity- Crocco number- Bernoulli equation- Isentropic flow through variable area- Comparison of isentropic and adiabatic flow- Mach number variations- Area ratio- Impulse function- Mass flow rate, Chocking in Isentropic flow- Variation of flow parameters in isentropic flow- Performance of convergent and De lavel nozzle- Performance of real nozzles- Applications of Isentropic flow.

Module III (10 hours)

Simple frictional flow: Governing equations- Fanno curves- Limiting conditions- Fanno flow equations- Variation of flow properties- Variation of Mach number with duct length- Choking due to friction. Isothermal flow with friction: Basic equations- Limiting conditions- Variation of flow properties. Flow with heat transfer: Governing equations- Rayleigh curves- Limiting condition- Rayleigh flow relations- Variation of flow properties- Maximum heat transfer- Thermal choking.

Module IV (9 hours)

Normal shock: Development of a shock wave- Governing equations- Intersection of Fanno and Rayleigh lines- Prandtl-Meyer relation- Properties of flow across normal shock- Thickness of shock waves- Shock strength- Determination of Mach number of supersonic flow- Variation of flow parameters through normal shock.

Module V (9 hours)

Air craft propulsion: Types of gas turbine engines- Components of a gas turbine engine- Energy flow through jet engines- Propeller and jet Thrust- propulsive and overall efficiency- Ramjet, Pulsejet and Scramjet engine. Rocket Propulsion: Types of rocket engines- Liquid propellant rockets and propellant feed system- Solid propellant rocket motors- Restricted and unrestricted burning- Rocket propulsion theory- Applications.

Text Books

1. S M Yahya, *Fundamentals of compressible flow with aircraft and rocket propulsion*, New Age International.
2. P Balachandran, *Fundamentals of compressible fluid dynamics*, Prentice Hall of India.
3. V Babu, *Fundamentals of gas dynamics,* Ane Books India.

Reference Books

1. A. H. Shapiro, *Dynamics and thermodynamics of compressible fluid flow (Vol-1)*, The Ronald Press Company.
2. Anderson, *Modern compressible flow with historical perspective*, Mc Graw Hill
3. James John & Theo Keith, *Gas Dynamics*, Pearson International.
4. Liepmann and Roshko*, Elements of gas dynamics*, Dover publications.
5. Zucrow M. J. & Jeo D Holfman ,*Gas dynamics (Vol 1)*, John Wiley

ME010 704: Refrigeration and Air Conditioning
(Common with AU010 704)

Teaching scheme **Credits:** 3

2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Refrigeration and Air Conditioning*
- *To develop a sound physical understanding of the subject so that the learner will demonstrate the ability to design a refrigeration or air-conditioning equipment that meets the required specifications*

Module 1 (8 hours)

Principles of refrigeration: Thermodynamics of refrigeration – Carnot, reversed carrot cycle, heat pump, and refrigerating machine- coefficient of performance -unit of refrigeration-refrigeration methods - conventional refrigeration systems. Air refrigeration system -Bell Coleman cycle -C.O.P –capacity, work and refrigerant flow requirements in Bell Coleman cycle.

Module 2 (10 hours)

Vapor compression system: simple cycle -comparison with Carnot cycle, theoretical and actual cycles- COP- effect of operating parameters on COP- wet, dry and superheated compression- sub cooling - actual cycle representation on TS and PH diagrams- simple problems. Advanced vapor compression systems – multistage vapor compression systems- flash chamber- multiple compression and evaporation systems- cascading -simple problems.

Module 3 (10 hours)

Vapor absorption systems: simple cycles-actual cycle- ammonia water and lithium bromide water systems – COP -Electrolux system. Refrigerant and their properties: Nomenclature-suitability of refrigerants for various applications -unconventional refrigeration methods- vortex tube, steam jet, magnetic (Cryogenics) refrigeration and thermoelectric refrigeration- applied refrigeration: house hold refrigerator –unit air conditioners and water coolers- ice plant -cold storage

Module 4 (7 hours)

Refrigeration system components (Theory Only): water and air cooled condensers- evaporative condensers- expansion devises -capillary tube -constant pressure expansion valve- thermostatic expansion valve- float valve and solenoid valve. Evaporators: natural convection coils -flooded evaporators -direct expansion coils. Reciprocating compressors: single stage and multistage compressors- work done -optimum pressure ratio -effect of intercooling- volumetric efficiency -

effect of clearance- isothermal and adiabatic efficiency. Rotodynamic compresors: Screw and vane type compressors- principle of operation- hermetic, semi hermetic and open type refrigeration compressors.

Module 5 (10 hours)

Principles of air conditioning: Psychrometry and psychrometric chart - human comfort- effective temperature- comfort chart. Applied psychrometry: sensible heat factor- psychometric process – problems. Winter air conditioning- heating load calculations- humidifiers and humidistat. Summer air conditioning- cooling load calculations- year round air conditioning -unitary and central systems -principles of air distribution -design of air duct systems.

Text Books

1. Stoecker W.F. and Jones J.W, *Refrigeration and Air-Conditioning*, McGraw- Hill
2. Jordan and Prister, *Refrigeration and Air-Conditioning*, Prentice Hall of India.

Reference Books

1. Dossat., *Principles of Refrigeration*, John Wiley and Sons
2. Robert H. Enerick, *Basic Refrigeration and Air-Conditioning*, Prentice Hall.
3. Arora C.P., *Refrigeration and Air-Conditioning*, Tata McGraw- Hill

ME 010 705: Industrial Engineering
(Common with AU010 705)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To provide an exposure to the fundamental tools and techniques in Industrial Engineering for integration and improvement of inter related work activities and productivity management.*

Module I (9 hours)

Introduction: Evolution of industrial Engineering, Branches and Fields of application of Industrial Engineering, Functions of Industrial Engineer. Types of production- Productivity- Productivity index- factors affecting productivity-techniques for productivity improvement.

Product development and design: Requirements of a good product design- product development process- product analysis. Value Engineering: Fundamental Concepts- reasons for poor values- types of values- Applications and benefits of Value Engineering.

Module II (9 hours)

Facility planning: Plant location-Procedure for site selection- Plant layout-Objectives and principles of plant layout- types of layout- Factors influencing layout- introduction to layouts based on group technology, just-in-time and cellular manufacturing systems.

Material Handling: Functions and Principles of material handling, Selection of material handling equipments-types of material handling equipments.

Module III (9 hours)

Materials Management: Objectives, functions and scope of materials management. **Purchasing** - Objectives and functions-purchasing procedure- buying techniques- Vendor development and rating system- Stores management.

Inventory Control: Objectives of inventory control-inventory costs-Determining inventory level- EOQ model-Models with shortages-Continuous and Periodic Review systems-ABC analysis- Make or buy decision-Vendor Managed Inventory.

Module IV (9 hours)

Methods engineering: Work study-Procedure for motion study- Recording Techniques- Micro motion study- Work measurement techniques- Time study.

Industrial Ergonomics: Introduction to Ergonomics-Objectives of Human Engineering- Aspects of Man- Machine System- Workplace design.

Job Evaluation and Merit Rating: Objectives of Job evaluation, methods of job evaluation, merit rating, Types of merit rating.

Module V (9 hours)

Inspection and Quality Control: Objectives and kinds of inspection-methods of inspection-Objectives of quality control- Statistical quality control-control charts, problems- Acceptance sampling-Total quality management- ISO systems-QFD- Benchmarking.

Text Books

1. Verma A.P., *Industrial Engineering*, S. K. Kataria & Sons.
2. Sharma S. C. & Banga T. R., *Industrial Organization and Engineering Economics,* Khanna Publishers.

Reference Books

1. Tompkins J.A and White J.A. , *Facilities Planning*, John Wiley, N.Y.,1984.
2. Tony Arnold, J.R, *Introduction to materials management*, Prentice hall inc, N.J,1998.
3. Tayyari and Smith J.L., *Occupational Ergonomics; principles and Applications,* Chapman and Hall publication, U.K., 1997

ME 010 706 L01: PLANT ENGINEERING AND MAINTENANCE

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *The course is designed to develop an understanding of maintenance tools and techniques in the new industrial world.*

Module 1 (12 hours)

Fundamentals of plant engineering - Plant facilities - Layout of facilities, basic amenities etc. Types of maintenance- breakdown, preventive, periodic or predictive, condition based maintenance- deterioration and failure analysis- planning, scheduling, and controlling of maintenance work- organization for maintenance.

Module 2 (12 hours)

Wear: Sliding wear tests – Archard wear equation – unlubricated wear of metals - wear regime maps for metals – mechanism of sliding wear of metals : plasticity dominated wear, Oxidative wear – lubricated wear of metals – fretting wear of metals – wear of ceramics and polymers.

Module 3 (12 hours)

Reliability: concept and definition-chance failure and wear out failure -application of stochastic model for reliability studies- reliability of series, parallel and stand by systems- estimation of parameters of failure distribution- maintainability and availability.

Replacement: causes of deterioration and obsolescence- sudden and gradual obsolescence and deterioration- economic analysis- MAPI method- simple problems.

Module 4 (12 hours)

Condition based maintenance using Vibration Signature, SOAP, ferrography, hot ferrography, Infra Red Camera, fluorescent dye, Particle Analyzers and other diagnostic techniques.

Reliability Centered Maintenance- Total Productive Maintenance- Tero-technology and its influence on plant engineering and maintenance. Overall equipment effectiveness (OEE) – Reliability Availability and Maintainability analysis (RAM).

Module 5 (12 hours)

Safety management: fire protection and prevention - safety against mechanical hazards, chemical hazards- accident prevention program- Industrial noise - Pollution control- Waste disposal - Recycling of waste - Energy conservation, management and audit - legal provisions for safety in industry.

Text Books

1. Collacott R.A., *Mechanical fault Diagnosis and Condition Monitoring*, Chapman and Hall Ltd.
2. Sushikumar Srivastava, *Industrial Maintenance Management*, S. Chand and Co. Ltd., New Delhi.

Reference Books

1. Rosaler R., *Handbook of Plant Engineering*, McGraw Hill.
2. Mobley K., Higgins L.R., *Handbook of Maintenance Engineering*, McGraw Hill.
3. Hutchings I. M., *Trobology: friction and wear of engineering materials,* Edward Arnold
4. Robinowicz Ernest, *Friction and wear of materials,* John Wiley

ME010 706L02: Turbo Machines

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To impart the basic concepts of various turbo machines like blowers, fans, compressors and turbines.*

Module I (12 hours)

Principles: Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

Module II (12 hours)

Centrifugal Fans and Blowers: Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

Module III (12 hours)

Centrifugal Compressor: Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Module IV (12 hours)

Axial Flow Compressor: Stage velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.

Module V (12 hours)

Axial and Radial Flow Turbines: Stage velocity diagrams, reaction stages, losses and coefficients blade design principles, and testing and performance characteristics.

Text Books

1) Yahya, S.H., *Turbines, Compressor and Fans*, Tata Mc Graw Hill Publishing Company, 1996.
2) B K Venkanna, *Fundamentals of Turbomachinery*, Prentice Hall of India, 2009

Reference Books

1. Bruneck, *Fans*, Pergamom Press, 1973.
2. Earl Logan, Jr., *Hand book of Turbomachinery*, Marcel Dekker Inc., 1992.
3. Dixon, S.I., *Fluid Mechanics and Thermodynamics of Turbomachinery*, Pergamom Press, 1990.
4. Shepherd, D.G., *Principles of Turbomachinery*, Macmillan, 1969.
5. Stepanff, A.J., *Blowers and Pumps*, John Wiley and Sons Inc., 1965
6. Ganesan .V. *Gas Turbines*, Tata Mcgraw Hill Pub.Co., New Delhi, 1999.

ME010 706 L03 Theory of vibration

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the basic concepts and issues related to vibration*

Module I (12 hours)

Fundamentals of vibration

Introduction, Definitions, Vector method of representing harmonic motions, Additions of two Simple Harmonic Motions of the same Frequency, Beats Phenomenon.

Undamped free vibrations of single degree of freedom

Introduction, Derivation of differential equation, Solution of differential equation, Torsional Vibrations, equivalent stiffness of Spring Combinations, Energy Method.

Module II (12 hours)

Damped free vibrations of single degree of freedom system

Introduction, Different types of Damping, Free Vibrations with viscous damping, Logarithmic decrement, Viscous dampers, Dry Friction or Coulomb damping, Solid or Structural damping.

Module III (12 hours)

Forced vibrations with constant harmonic excitation

Introduction, Forced Vibrations with constant harmonic excitation, Forced Vibrations due to excitation of the Support, Energy dissipated by damping, Forced vibrations with Coulomb damping, Forced vibrations with Structural damping, Determination of Equivalent viscous damping from frequency-response curve, Vibration isolation and transmissibility, Vibration measuring instruments, Critical speed of shafts

Module IV (12 hours)

Two degree of freedom systems

Introduction, Principal modes of Vibration, Other cases of simple two degrees of freedom systems, Combined rectilinear and angular modes, Systems with damping, Undamped forced vibrations with Harmonic excitation, Vibration absorbers, Vibration Isolation Natural frequencies and mode shapes (eigenvalues and eigenvectors), orthogonal properties of normal modes, Introduction to Model analysis,

Module V (12 hours)

Continuous systems – vibrating strings - axial vibration of rod – transverse vibration of beams – torsional vibration of shafts.

Text Books

1. Leonard Meirovitch, "Fundamentals of Vibrations", International Edition, McGraw-Hill, 2001.

2. Singiresu S Rao, “Mechanical Vibrations", Fourth Edition, Pearson.

3. V. P. Singh, “Mechanical Vibrations", Dhanpat Rai & sons

4. William T Thomson, “Theory of Vibration with applications", Prentice Hall, 1993.

ME010 706 L04 Sales and Marketing Management

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Module 1 (12 hours)

Marketing: Definition- Marketing concepts- Market segmentation- Market demand- Product-Value and satisfaction- Exchange and transactions- Marketing channels- Competition- Marketing environment- Marketing mix.
Marketing Management: Functions-Sales forecasting-Pricing-Distribution- Advertising- Sales promotion- Marketing research.

Module 2 (12 hours)

Strategic Planning: Strategic business unit (SBU)- Business strategic planning- SWOT analysis. Marketing decision support system.

Module 3 (12 hours)

Product life cycle: Marketing strategies in the different stages of product life cycle.
New product development: Idea generation- Concept development and testing conjoint analysis.
Introduction to Relationship marketing, International marketing and on line marketing.

Module 4 (12 hours)

Consumer behaviour: Major factors affecting consumer buying behavior- Consumer decision making process.
Organizational buying behavior: Buying situations- the buying center-Purchasing process.

Module 5 (12 hours)

Sales management: Evolution of Sales management- Objectives of Sales management- Personal selling situations- Theories of selling- Basic selling styles- Recruitment, selection and training of sales personnel-Sales territory-Sales quotas.

References
1. Marketing Management - Philip Khotler
2. Sales Management - Richard, Edward & Norman
3. Industrial Engg & Management - O.P.Khanna
4. Industrial Organisation & Management - Banga & Sarma
5. Organisational Behaviour - Fred Luthans

6. Consumer Behaviour - Schifman & Kanuk
7. Basic marketing - Gundiff
8. Marketing Management for small units - Jain
9. Sales Engg - Lester
10. Salesmanship concept - Thomson

ME010 706 L05 Failure Analysis and Design

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *To introduce basic concepts of reliability in analysis and design*
- *To study fracture, fatigue and other modes of failure*

Module1 (12 hours)

Reliability: Reliability concept and hazard function, life prediction, condition monitoring, application of Poisson, exponential and Weibull distribution for reliability - bath tub curve - parallel and series system - mean time between failures and life testing.

Stresses in a body: Two dimensional and three dimensional state of stress, Mohr's circle two and three dimensions, hydrostatic stress, Von-mises, maximum shear stress (Tresca), octahedral shear stress, torsional stresses for large plastic strain.

Module 2 (12 hours)

Fracture: Types of fracture, Griffith crack theory, stress analysis of cracks, metallographic aspects of fracture. Brittle, ductile fractures, notch effects, fracture curve, R curve, fracture under combined stresses, effect of hydrostatic pressure on fracture, probabilistic aspects of fracture mechanics, toughness of materials.

Module 3 (12 hours)

Fatigue: Statistical nature of fatigue, S-N curve, low cycle fatigue, strain life equations, structural feature of fatigue, fatigue crack propagation, effect of stress concentration, size, surface properties, metallurgical variables on fatigue, case studies, designing against fatigue, detail design, improvements after failure and service, fatigue of bolts, welded and adhesive joints.

Fatigue tests: Purpose, specimen, fatigue test procedures, evaluation of fatigue test results, crack growth measurement.

Module 4 (12 hours)

Wear failures: Type of wear, role of friction in wear, lubricated and non-lubricated wear, analysing wear failures, wear tests SOAP, ferrography.

Corrosion failures: Factors influencing corrosion failures, analysis of corrosion failures, overview of various types of corrosion, stress corrosion cracking - sources, characteristics of stress corrosion cracking, procedure of analysing stress corrosion cracking, various types of hydrogen damage failures, corrective and preventive action.

Module 5 (12 hours)

Elevated temperature failures: Creep, stress rupture, elevated temperature fatigue, metallurgical instabilities, environmental induced failure, elevated temperature effects on certain gas turbine components and petroleum refinery components, tests for analysis of failure at elevated temperatures.

References

1. Jaap Schijve, “Fatigue of Structures and Materials”, Kluwer Academic Publishers, 2001.
2. ASM Metals Handbook, "Failure Analysis and Prevention", ASM Metals Park, USA, Vol. 10, 10th Edition, 1995.
3. Richard W Hertzberg,“Deformation and Fracture Mechanism of Engineering Materials”,John Wiley & Sons,Inc.,1995.
4. George E Dieter, “Mechanical Metallurgy”, McGraw Hill Book Company, 1988.

ME 010 706 L06 Foundary and Welding Technology

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Foundary Technology

Module 1 (12 hours)

Degassing: Gas Porosity **– Molten Metal Filtration**: sources of inclusions, methods for removal of inclusions – **Castability**: factors influencing fluidity, hot tearing - **Semisolid Metal Processing** - viscosity evolution during continuous cooling - **Rapid Solidification**: microstructural modification, heat flow - **Solidification during Casting of Metal-Matrix Composites**:- incorporation of reinforcements, reinforcement-metal wettability, solidification, distribution of reinforcements.

Module 2 (12 hours)

Hot Isostatic Pressing of Castings:- Reasons for using HIP, effect of HIP on mechanical properties, effect of HIP on the shape and structure of castings, problems encountered in HIP, economics of HIP **– Low Pressure Metal Casting**:- conventional methods, low-pressure furnace and tooling, cores, vacuum riserless/pressure riserless casting **– High Pressure Die Casting**:- die casting alloys and processes, hot and cold chamber, advantages, disadvantages - **Hot and Cold Chamber Die Casting**:- melting process, injection components, distinctions between hot and cold chamber processes, gate and runner design, temperature control.

Module 3 (12 hours)

Vacuum High-Pressure Die Casting:- vacuum riserless casting, high-vacuum die casting – **Semisolid Casting** (SSM):introduction, fundamentals: advantages of SSM processing, SSM processing - **Aluminum and Aluminum Alloy Castings**: effects of alloying and impurity elements, structure control, secondary dendrite arm spacing, nondendritic microstructures, grain structure, grain-refinement, welding, molten metal fluidity, hot cracking - **Titanium and Titanium Alloy Castings**: effects of alloying elements, microstructures of titanium castings, cast microstructure of Ti - 6Al - 4V, melting and pouring, molding methods, postcasting practice, welding, heat treatment **- Nickel and Nickel Alloy Castings**: structure and property correlations, melting practice and metal treatments, foundry practice, pouring practice, gating systems, risers, welding, heat treatment and applications.

Welding Technology

Module 4 (12 hours)

Heat Flow in Fusion Welding - Fluid flow phenomena during Welding: mass transport in the arc in gas tungsten arc welding, deep-penetration electron beam and laser welds, in gas metal arc welding, in submerged arc welding.

Module 5 (12 hours)

Transfer of Heat and Mass to the base metal in gas metal arc welding - Arc Physics of Gas - Tungsten Arc Welding: electrode regions and arc column - Introduction to **Special Welding processes**: **Underwater** Welding: underwater welding pyrometallurgy, micro structural development of underwater welds, heat sources, applications - welding for **cryogenic** service - welding in **space** and low - gravity environments: metallurgy of low-gravity welds.

TEXT BOOKS:

1. ASM Handbook, Volume 15, Casting, ASM International, Metals Park, Ohio, USA.
2. ASM Metals Handbook. Volume 6, Welding Brazing and Soldering, ASM International, Metals Park, Ohio, USA, 1993.

REFERENCE BOOKS:

1. Amstead B.H., Phillip E Ostwald and Myron L.Begeman, “Manufacturing Processes” John Wiley & Co., New York.
2. American Welding Society, Welding handbook, Vol. 1 and 2, 7th edition.
3. AWS Welding Handbooks, AWS, New York, 1995.
4. Flimm, Fundamentals of Metals Casting, Addison Wesley.
5. Gourd L.M., Principles of Welding Technology, ELBS/ Edward Arnold.
6. Howard B Cary., Modern Welding Technology, 4th edition, Prentice Hall, New Jersey, USA, 1997.
7. Koenigsberger and Adaer, Welding Technology, Macmillan.
8. Lancaster, The Physics of Welding; Pergaman Press.
9. Lancster and George Allen, The Metallurgy of Welding, Unwin Ltd. U.K.
10. Lincoln Electric Co, Procedure Handbook of ARC Welding; Lincoln Electric Co. USA.
11. Richard W.Heine, Carl R.Loper and Phlip C.Rosenthal, “Principles of Metal Casting”, Tata McGraw Hill, New Delhi.
12. Rossi, Welding Technology, McGraw Hill.
13. Salman and Simans, Foundry Practice, Issac Pitman.
14. Tylecote, The Solid Phase Welding of Metals, Edward Arnold Pvt. Ltd.

ME 010 707 Mechanical Measurements Laboratory

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To provide an exposure to the fundamentals of metrology*
- *To understand the need of precision measurement and measuring instruments*

1. Study and use of laser interferometer for calibration of linear measurements.
2. Study of slip gauges – wringing – surface roughness - standards.
3. Study of surface plates, straight edges, angle plate, V-block etc and applications.
4. Measurement of out of roundness using roundness measuring instrument, V block and dial indicator etc. - reasons for out of roundness etc.
5. Measurements of straightness using sprit level and auto collimator.
6. Measurement of thread parameters using three wire method.
7. Measurement of tool angles of single point tool using tool maker's microscope.
8. Measurement of gear parameters using profile projector.
9. Evaluation of straightness error using autocollimator, sprit level, straight edge etc.
10. Calibration and determination of uncertainties of the following;
    a. Strain gauge load cells
    b. Bourdon tube pressure gauge
    c. LVDT
    d. Thermocouples
    e. Tachometers and stroboscopes, etc.
11. Study and measurement of surface roughness using surface roughness instrument.
12. Study and measurements with coordinate measuring machines.
13. Experiments on limits and fits.
14. Study and use of ultrasonic flaw detector.
15. Study of different types of dial indicators - stands and holders for dial gauges.
16. Study and use of different types of comparators.
17. Exercises on measurement system analysis
18. Study and making measurements with precision vernier calipers, dial calipers, spline micrometer, point micrometer, wire groove micrometer, depth micrometer, V- anvil micrometers, depth gear tooth micrometer, thread micrometer, disc micrometer, thread pitch gauge, vernier height gauge, slip gauges, optical flat, three pin micrometer,

pyrometer, RTD, bore dial gauge, depth gauge, pitch gauge, thickness gauge, radius gauge, hole test, bench center etc.

19. Angular measurements using bevel protractor, sine bar, clinometers etc.
20. Measurement of vibration.
21. Analysis of automobile exhaust gas and flue gas.
22. Study and determination of area using planimeter.
23. Polishing, etching and determination of grain size and microstructure studies using optical microscope.

TEXT BOOKS:

1. Sharp K.W.B., Practical Engineering Metrology, Sir Isaac Pitman and sons Ltd, London, 1958.
2. Shotbolt C.R. and Gayler J.F.W, Metrology for Engineers, 5^{th} edition, ELBS, London.

REFERENCE BOOKS:

1. Figliola, Richard S, and Beasley, Donald E, “Theory and Design for Mechanical Measurements”, Third edition, John Wiley and Sons Inc.
2. Collett, C.V. and Hope, A.D, “Engineering Measurements”, Second edition, ELBS/Longman.
3. Tarasevigh Y. and Yavosih E., Fits, Tolerances and Engineering Measurements, Foreign language publishing house, Moscow.

ME 010 708 Advanced Machine Tools Laboratory

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To understand the different process parameters involved in shaping, slotting, milling, grinding machines.*
- *To analysis the causes for the variation on surface roughness obtainable in different machining process.*

PART – A

1. Experiment on shaping machine: - flat surfaces, dovetail cutting – grooving, keyway cutting etc. **- 2 practices.**

2. Experiment on slotting machine: - flat surfaces, dovetail cutting – grooving, keyway cutting etc. - making hexagonal hole using slotting machine. **- 2 practices.**

3. Study of milling machines – nomenclature of milling cutters – different types of milling cutters – attachments for milling:- vertical milling and universal milling attachment, high speed milling attachment, rack milling and slot attachments, parking bracket, rotary table, universal dividing head, vices, arbors, adaptors and collet chucks. **- 1 practice.**

4. Experiment on milling machine: - 1 - plane milling, keyway cutting, cutting of splines.
- 1 practice.

5. Experiment on milling machine: - 2 – cutting of spur, helical and bevel gears – study of different methods of indexing - multi slot cutting on milling machine by indexing.
- 3 practices.

6. Study of surface grinding machine and demonstration of grinding of plane surface - study of cylindrical grinding machine and demonstration of plane cylindrical grinding – study and demonstration of planing machine – study and demonstration of broaching machine.
- 2 practices.

PART – B

Preparation of control charts - preparation of laboratory layout - facilities layout analysis– materials requirement planning – inventory analysis –preparation of process plan and cost estimation for the manufacture of various products – study of a jig and a fixture for drilling and milling operation - fabrication of simple bending dies – Preparation of process plans using CAPP software. **- 3 practices.**

Besides to the skill development in performing the work, oral examination should be conducted.

A detailed report on the work carried out on part – B is also to be prepared. Observation and record books are to be maintained for both part A and B.

The student's assessment, continuous evaluation, awarding of sessional marks, record bonafides, oral examination etc and University examination shall be carried out by the faculty members (Assistant professor and above).

TEXT BOOKS:

1. Acharkan. N., Machine Tool Design Vol. 1 to 4, MIR Publication.

REFERENCE BOOKS:

1. Chapman, Workshop Technology, Vol II, ELBS.
2. HMT, Production Technology, Tata McGraw Hill.
3. Yoram Koren, Numerical Control of Machine Tools, McGraw-Hill.

ME 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

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ME 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

❖ Relevance of the project proposed
❖ Literature survey
❖ Objectives
❖ Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7^{th} semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

ME010 801 Design of Transmission Elements
(Common with AU010 801)

Teaching scheme **Credits:** 4

2 hours lecture, 2 hour tutorial and 1 hour drawing per week

Objectives

To provide basic design skill with regard to various transmission elements like clutches, brakes, bearings and gears.

Module I (20 Hrs)

Clutches - friction clutches- design considerations-multiple disc clutches-cone clutch- centrifugal clutch - Brakes- Block brake- band brake- band and block brake-internal expanding shoe brake.

Module II (17 Hrs)

Design of bearings - Types - Selection of a bearing type - bearing life - Rolling contact bearings - static and dynamic load capacity - axial and radial loads - selection of bearings - dynamic equivalent load - lubrication and lubricants - viscosity - Journal bearings - hydrodynamic theory - design considerations - heat balance - bearing characteristic number - hydrostatic bearings.

Module III (19 Hrs)

Gears- classification- Gear nomenclature - Tooth profiles - Materials of gears - design of spur, helical, bevel gears and worm & worm wheel - Law of gearing - virtual or formative number of teeth- gear tooth failures- Beam strength - Lewis equation- Buckingham's equation for dynamic load- wear load- endurance strength of tooth- surface durability- heat dissipation - lubrication of gears - Merits and demerits of each type of gears.

Module IV (16 Hrs)

Design of Internal Combustion Engine parts- Piston, Cylinder, Connecting rod, Flywheel

Design recommendations for Forgings- castings and welded products- rolled sections- turned parts, screw machined products- Parts produced on milling machines. Design for manufacturing - preparation of working drawings - working drawings for manufacture of parts with complete specifications including manufacturing details.

Note: Any one of the following data book is permitted for reference in the final University examination:

1. Machine Design Data hand book by K. Lingaiah, Suma Publishers, Bangalore/ Tata Mc Graw Hill
2. PSG Design Data, DPV Printers, Coimbatore.

Text Books

1. C.S,Sarma, Kamlesh Purohit, Design of Machine Elements Prentice Hall of India Ltd NewDelhi
2. V.B.Bhandari, Design of Machine Elements McGraw Hill Book Company
3. M. F. Spotts, T. E. Shoup, Design of Machine Elements, Pearson Education.

Reference Books

1. J. E. Shigley, Mechanical Engineering Design, McGraw Hill Book Company.
2. Juvinall R.C & Marshek K.M., Fundamentals of Machine Component Design, John Wiley
3. Doughtie V.L., & Vallance A.V., Design of Machine Elements, McGraw Hill Book Company.
4. Siegel, Maleev & Hartman, Mechanical Design of Machines, International Book Company.

ME010 802 Operations Management
(Common with AU010 802)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To familiarize the main decision making scenarios (strategic, tactical and operative) an Operations Manager may come across.*
- *To develop an understanding of the main OM principles, techniques and tools to analyze, diagnose and then to improve processes.*

Module I (12 hours)

Introduction to Operations Management- Functions of Operations Management, Strategic, Tactical and Operational decisions. Forecasting in decision making: Factors affecting forecasting, Sources of data, Time series analysis, Demand patterns, Forecasting methods- Moving average, Regression, Exponential smoothing-problems, Qualitative methods- Measures of forecast accuracy.

Module II (12 hours)

Aggregate Planning: Aggregate planning strategies and methods, Transportation model for aggregate planning. Master Production Schedule- Materials Requirement Planning, Bill of materials, Lot sizing in MRP, MRP-II, CRP, DRP.

Module III (12 hours)

Introduction to Scheduling: Single machine scheduling, Flow shop scheduling, Job shop scheduling. Sequencing: Johnson's algorithm, Processing *n* jobs through two machines, processing *n* jobs through three machines, processing *n* jobs through *m* machines, processing two Jobs through *m* machines-problems.

Module IV (12 hours)

Maintenance Planning and Control: Types of maintenance, Need for replacement, Replacement problems, Individual replacement policy, Group replacement policy, TPM. Reliability – Bath tub curve- reliability improvement, Measures for maintenance performance, reliability calculations, FMECA, information system for maintenance management.

Module V (12 hours)

Modern concepts/ techniques in operations management: Just in time manufacturing, Lean manufacturing, Push Pull Production, Kanban systems, Flexible manufacturing systems, ERP.

Supply Chain management: Supply chain, objective of Supply Chain, Supply chain macro processes, Process view of a supply chain, Drivers of Supply Chain.

Text Books

1. Mahadevan B., *Operations Management*, Pearson Education.
2. Panneerselvam R., *Production and operations Management*, Prentice Hall of India.

Reference Books

3. Krajewski and Ritzman, *Operations Management*, Pearson Education.
4. Verma A.P., *Industrial Engineering*, S. K. Kataria & Sons.
5. Adam and Ebert, *Production and Operations Management*, Prentice Hall of India.
6. Chopra and Meindl, *Supply Chain Management*, Prentice Hall of India.

ME 010 803 Production Engineering

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Module 1 (12 hours)

Theory of metal cutting: Scenario of manufacturing process – Deformation of metals, Schmid's law (review only) – Performance and process parameters – single point cutting tool nomenclature - attributes of each tool nomenclature - attributes of feed and tool signature on surface roughness obtainable, role of surface roughness on crack initiation - Oblique and orthogonal cutting – Mechanism of metal removal - Primary and secondary deformation shear zones - Mechanism of chip formation, card model, types of chip, curling of chips**,** flow lines in a chip, BUE, chip breakers, chip thickness ratio – Mechanism of orthogonal cutting: Thin zone and thick zone, Merchant's analysis – shear angle relationship, Lee and Shaffer`s relationship, simple problems – Friction process in metal cutting: nature of sliding friction, columb`s law, adhesion theory, ploughing, sub-layer flow – Empirical determination of force component.

Module 2 (12 hours)

Thermal aspects of machining: Source of heat, temperature distribution pattern in chip, shear plane and work piece, effect of speed, feed and depth of cut – tool temperature measurement - **Tool materials**: properties of tool material, Carbon steel, HSS (classification, structure, composition, properties) - cemented Carbides (structure, properties), indexable inserts, coated WC, cermets – alumina (ceramic), sialon, cubic Boron Nitride (cBN), diamond, diamond coated tools – **Tool wear**: flank and crater wear – Tool **wear mechanisms**: adhesion, abrasion, diffusion and fatigue – **Tool life**, Taylor's equation, applications - effect of rake angle, clearance angle, chip temperature and cutting time on tool life, simple problems - Tool **wear criterion**: allowable wear land etc - **Economics** of machining – **machineability** of Ti, Al, Cu alloys and machineability index – cutting force (quartz crystal dynamometer) - **Cutting fluids**: effect of specific heat on selection of fluids, functions, classifications, specific applications.

Module 3 (12 hours)

Powder Metallurgy: **Need** of P/M - **Powder Production** methods:- Atomization, electrolysıs, Reduction of oxides, Carbonyls (Process parameters, characteristics of powder produced in each method) – **Powder characteristics**: properties of fine powder, size, size distribution, shape, compressibility, purity etc.- **Mixing** – **Compaction**:- techniques, pressure distribution, HIP & CIP, – Mechanism of **sintering,** driving force, solid and liquid phase sintering - Impregnation and Infiltration Advantages, disadvantages and specific applications of P/M.

Micromachining: Diamond turn mechanism, material removal mechanism-Magnetorheological nano-finishing process: - polishing fluid, characteristics of MRP fluid, MRF and MRAFF process.

Module 4 (12 hours)

Ceramic Structures and properties**: -** coordination number and radius rations **-** AX, A_mX_p, $A_mB_mX_p$ type crystal structures – imperfections in ceramics- phase diagrams of Al_2O_3 – Cr_2O_3 and MgO- Al_2O_3 only – mechanical properties – mechanisms of plastic deformation – ceramic application in heat engine, ceramic armor and electronic packaging.

Fundamentals of **Composites: -** particle reinforced composites **–** large particle composites - fiber reinforced composites: influence of fiber length, orientation and concentration-fiber phase – matrix phase.

Module 5 (12 hours)

Advanced production methods: **Nontraditional machining**: EDM, ECM, USM, EBM, LBM, IBM, Abrasive water jet machining (principle, process parameters, material removal mechanism, MRR, surface roughness, HAZ and applications) – **Material addition process**:- stereo-lithography, selective laser sintering, fused deposition modeling, laminated object manufacturing, laser engineered net-shaping, laser welding, LIGA process.

TEXT BOOKS:

1. Armarego and Brown, The Machining of Metals, Prentice – Hall.
2. Bhattacharyya, Metal Cutting Theory and Practice**,** Central Publishers. Wiley
3. Paul. H. Black, Theory of Metal Cutting, McGraw Hill.

REFERENCES BOOKS:

1. ASM hand book Volume 16, Machining, ASM international, 1989
2. Boothroyd Geoffrey, Fundaments of Machining and Machine Tools, Marcel Dekker, 1990.
3. Brophy, Rose and Wulf, the Structure and Properties of Metals Vol.2, Wiley Eastern.
4. Dixon and Clayton, Powder Metallurgy for Engineers, Machinery Publishing Co. London.
5. Jain V.K., Introduction to Micromachining, Narosa publishers.
6. Juneja B.L. Fundamentals of metal cutting and machine tools, Wiley, 1987.
7. Komanduri R, Tool materials in Kirk Othmer Encyclopedia of chemical technology, 4^{th} edition, volume 24, 390, Wiley, 1997.
8. Lal G.K., Introduction to Machining Science, New Age Publishers.
9. Machining date hand book, Volume 1 and 2, Machinability date center, Cincinnati, 1990.
10. Shaw Milton C, Metal Cutting Principles, CBS Publishers.
11. Trent M. Edward, Metal Cutting, Butterworth.
12. Venkatesh V.C. and H.Chandrasekaran, Experimental techniques in metal cutting, Prentice Hall, 1987.

Electives - III

ME010 804 L01 Aerospace Engineering

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module 1 (12 hours)

The atmosphere: Characteristics of Troposphere, Stratosphere, Mesosphere and Ionosphere - International Standard Atmosphere – Pressure, Temperature and Density variations in the International Standard Atmosphere – Review of basic fluid dynamics – continuity, momentum and energy for incompressible and compressible flows – static, dynamic and stagnation pressures – phenomena in supersonic flows

Module 2 (12 hours)

Application of dimensional analysis to 2D viscous flow over bodies – Reynolds number – Mach number similarity – Aerofoil characteristics – Pressure distribution – Centre of Pressure and Aerodynamic Center – Horse shoe vortex

Module 3 (12 hours)

Momentum and Blade Element Theories – Propeller co-efficients and charts – Aircraft engines – Turbo jet, Turbo fan and Ram Jet engines – Bypass and After Burners

Module 4 (12 hours)

Straight and Level Flight – Stalling Speed – Minimum Drag and Minimum Power conditions – Performance Curves – Gliding – Gliding angle and speed of flattest glide – Climbing – Rate of Climb – Service and Absolute Ceilings – Take off and Landing Performance – Length of Runway Required – Circling Flight – Banked Flight – High Lift Devices – Range and Endurance of Air planes.

Module 5 (12 hours)

Air speed indicators – Calculation of True Air Speed – Altimeters – Rate of Climb meter – Gyro Compass – Principles of Wind Tunnel Testing – Open and Closed type Wind Tunnels – Pressure and Velocity Measurements – Supersonic Wind Tunnels (description only) – Rocket Motors – Solid and Liquid Propellant Rockets – Calculation of Earth Orbiting and Escape Velocities Ignoring Air Resistance and assuming Circular Orbit.

References

1. Mechanics of Flight - Kermode A. C.

2. Aerodynamics for Engineering Students - Houghton and Brock
3. Airplane Aerodynamic – Dommasch
4. Anderson J.D. Jr., (2007), Fundamentals of Aerodynamics, Tata McGraw-Hill, New Delhi.
5. Karamcheti K., (1966), Principles of Ideal-Fluid Aerodynamics, John Wiley & Sons Inc.
6. Bertin J.J., (2002), Aerodynamics for Engineers, 4th Ed. Prentice-Hall Inc.
7. Kuethe A. M. and Chow C.-Y., (1986), Foundations of Aerodynamics, John Wiley & Sons Inc.
8. Kundu P.K. & Cohen I.M., (2008), Fluid Mechanics, Elsevier Inc.

ME010 804L02 Advanced Machining Process

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objective: - To understand the need of smaller high quality parts and components.

Module 1 (12 hours)

Diamond turn machining (DTM):-Types of DTM - component of machine - components of DTM: spindle system, workpiece tool positioning system, machine support system, tool measurement system, machine control system – material removal mechanism in DTM – ductile regime machining – tools for DTM – tool geometries for single crystal diamond tools – tool setting – applications.

Abrasive jet micro machining (AJMM):- machining system – masking technology – erosion mechanism – metal, photo-resist and elastomer mask – erosion behavior – surface properties: hardness and roughness – pressurized power feed system – fluidized bed powder spray system – factors affecting in constant feeding – nozzle configuration – applications.

Module 2 (12 hours)

Magnetorheological nanofinishing processes: - Magnetorheological polishing fluid – rheological characteristics of fluid **-** Magnetorheological finishing (MRF) processes - Magnetorheological abrasive flow finishing processes (MRAFF) – performance analysis of MRAFF process - Magnetorheological jet finishing processes:- working principle, MR jet finishing machine, polishing performance.

Micro/nano finishing with flexible flow of abrasives:- process principle and description – process technology – selection of media – effect of process parameters of performance – mechanism of material removal – process capabilities - applications.

Module 3 (12 hours)

Ultrasonic micromachining (USMM):- machine tool – elements of USMM –abrasive slurry – workpiece – mechanism of material removal – process parameters: machine based parameters – performance characteristics: machining rate, surface roughness, accuracy and tool wear – effect of process parameters on quality characteristics – effect of process parameters on accuracy – process capabilities.

Module 4 (12 hours)

Electron beam micromachining: - mechanism of material removal in EB drilling – importance of vacuum – process parameters – effect of cutting speed, pulsed beam operation, heat affected zone, cross sectional area of a beam – theoretical aspects of electron beam – energy transfer to the work material – applications.

Focused Ion beam machining:- equipment – imaging with FIB system – interaction of ion with substrate – FIB milling – gas assisted FIB processing – applications.

Module 5 (12 hours)

Micro-electric discharge micromachining:-principle of micro –EDM **–** influence of pulse characteristics – high aspect ratio holes – heat affected zone.

Laser micromachining:-laser beam characteristics – laser material interaction – micromachining system – nanosecond, picoseconds, femtosecond pulse micromachining.

Text Book:

Jain V.K. Introduction to micromachining, Narosa publishers.

References

1. M. Madou, "Fundamentals of Microfabrication"
2. D. Dornfeld, S. Min and Y. Takeuchi, Recent Advances in Mechanical Micromachining, CIRP Annals - Manufacturing Technology, Volume 55, Issue 2, 2006, Pages 745-768.

ME010 804L03 Cryogenics

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of Cryogenic Engineering*
- *To provide the learner with the fundamental knowledge about the properties of cryogenic materials, its storage and transfer systems*
- *To develop an understanding of various cryogenic liquefaction and refrigeration systems and their performances*

Module 1 (8 hours)

Introduction: Historical development- application of cryogenics -present areas involving cryogenic engineering-cryogenics in space technology- cryogenics in biology and medicine-superconductivity applications.

Module 2 (12 hours)

Basic thermodynamics applied to liquefaction and refrigeration process – isothermal, adiabatic and Joule Thomson expansion process -efficiency to liquefaction and coefficient of performances- irreversibility and losses. Low temperature properties of engineering materials: mechanical properties – thermal properties -electrical and magnetic properties. Properties of cryogenic fluids- superconductivity and super fluidity - materials of constructions for cryogenic applications.

Module 3 (15 hours)

Gas liquefaction systems: Production of low temperatures – general liquefaction systems-liquefaction systems for neon, hydrogen and helium.

Module 4 (15hours)

Cryogenic refrigeration systems: ideal refrigeration systems- refrigerators using liquids and gases as refrigerants- refrigerators using solids as working media - adiabatic demagnetization method.

Module 5 (10 hours)

Cryogenic storage and transfer systems: Cryogenic fluid storage vessels- cryogenic fluid transfer systems-cryo pumping.

Text Books

1. Barron R., *Cryogenic Systems*, Oxford Science Publications
2. Scott R.B., *Cryogenic Engineering*, Van Nostrand Co.

Reference Books

1. Mamata Mukhopadyay., *Fundamentals of Cryogenic Engineering*, PHI Learning
2. Haseldon G.G., *Cryogenic Fundamentals*, Academic Press
3. Flynn T.M., *Cryogenic Engineering*, Marcel Dekker.

ME010 804 L04 Acoustics and Noise Control

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives:

- *Elementary physical acoustics in 1D and its extension to simple 3D situations*
- *The significance of human factors in acoustics*
- *Fundamentals of architectural acoustics and noise control*

Module1 (12 hours)

Longitudinal wave propagation in a rod-Derivation of wave equation-Physical interpretation of the wave equation solution-One Dimensional Waves in a Gas-Acoustic Energy and Acoustic Intensity-Energy in a plane progressive wave-Acoustic Impedance

Module 2 (12 hours)

Sound Perception and the Decibel Scale-The ear-The decibel Scale-Combining Sound Levels in Decibels-Octave Bands-Loudness-The "A" Weighting-Legal requirements for noise control

Module 3 (12 hours)

Acoustic Resonance-Resonance of a pipe closed at both ends-Resonance of a pipe closed at one end, open at the other-Reflection & Transmission of Plane Acoustic Waves-Sound Transmission through layers and partitions-Transmission through a layer-Transmission through solid partitions

Module 4 (12 hours)

Room Acoustics-Acoustic Absorption-Reverberation Time-Sound Transmission between Rooms

The wave equation in 3 dimensions-Acoustic impedance of a spherical wave - near and far field effects-Source efficiency

Module 5 (12 hours)

Directionality of acoustic sources and receivers-Directivity index-Screens-Silencers

Helmholtz resonator design-Expansion chamber silencer design-Dissipative silencers

Active control of noise

References

1. Turner and Pretlove, Acoustics for Engineers, Macmillan, 1991
2. Kinsler, Frey, Coppens & Sanders. Fundamentals of Acoustics. 3rd Edition. John Wiley, 1982
3. Smith, Peters and Owen, Acoustics and Noise Control, Addison-Wesley-Longman, 2nd edition 1996
4. Bies and Hanson, Engineering Noise Control, theory and practice E&FN Spon, 2nd edition, 1996

ME010 804L05 Non Destructive Testing

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Module 1 (12 hours)
What is NDT,Comparison between destructive and NDT, Importance of NDT, Scope of NDT, difficulties of NDT, future progress in NDT, economics aspects of NDT.
Visual Inspection - tools, applications and limitations - Fundamentals of visual testing: vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods - mirrors, magnifiers, boroscopes, fibroscopes, closed circuit television, light sources and special lighting, a systems, computer enhanced system.
Liquid Penetrant Inspection: principles, properties required for a good penetrants and developers - Types of penetrants and developers, and advantages and limitations of various methods of LPI - **Magnetic Particle Inspection** - LPI technique/ test procedure, interpretation and evaluation of penetrant test indications, false indication, and safety precaution required in LPI, applications, advantages and limitations.

Module 2 (12 hours)
Magnetic Particle Inspection (MPI)- Principles of MPI, basic physics of magnetism, permeability, flux density, cohersiveforce, magnetizing force, rentivity, residual magnetis - Methods of magnetization, magnetization techniques such as head shot tecnique, cold shot technique, central conductor testing, magnetization using products using yokes, direct and indirect metod of magnetization, continous testing of MPI, residual tecnique of MPI, system sensitivity, checking devices in MPI, interpretation of MPI, indications, advantage and limitation of MPI - **Acoustical Holography**: Principles, types, applications, advantages and limitations.

Module 3 (12 hours)
Ultrasonic Testing (UT): principle, types of waves, frequency, velocity, wavelength, reflection, divergence, attenuation, mode conversion in ultrasonic UT testing methods - contact testing and immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe, ultrasonic testing techniques - resonance testing, through transmission technique, pulse echo testing technique, instruments used UT, accessories such as transducers, types, frequencies, and sizes commonly used, reference blocks wit artificially created defects, calibration of equipment, applications, advantages, limitations, A, B and C scan - Time of Flight Diffraction (TOFD).

Module 4 (12 hours)
Radiography Testing (RT): Principle, electromagnetic radiation sources: X-ray source, production of X-rays, high energy X-ray source, gamma ray source - Properties of X-rays and gamma rays - Inspection techniques like SWSI, DWSI, DWDI, panoramic exposure, real time radiography, films used in industrial radiography, types of film, speed of films, qualities of film, screens used in radiography, quality of a good radiograph, film processing, interpretation,

evaluation of test results, safety aspects required in radiography, applications, advantages and limitations of RT.

Module 5 (12 hours)

Eddy Current Testing (ECT) - Principle, physics aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance - Field factor and lift of effect, edge effect, end effect, impedance plane diagram in brief, depth of penetration of ECT, relation between frequency and depth of penetration in ECT, equipments and accessories, various application of ECT such as conductivity measurement, hardness measurement, defect detection, coating thickness measurement, advantages and limitations of eddy current testing.

Thermography: Principles, contact and non contact inspection methods - heat sensitive paints - heat sensitive papers - thermally quenched phosphors liquid crystals - techniques for applying liquid crystals - calibration and sensitivity - other temperature sensitive coatings - non contact thermographic inspection - advantages and limitation - infrared radiation and infra-red detectors, instrumentations and methods, applications.

TEXT BOOKS:

1. Baldev Raj, Practical Non – Destructive Testing, Narosa Publishing House (1997).

REFERENCE BOOKS:

1. Hull B. and V.John, Non-Destructive Testing, Macmillan (1988).
2. Krautkramer, Josef and Hebert Krautkramer, Ultrasonic Testing of Materials, Springer-Verlag.

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ME010 804 L06 Advance Operations Research

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *The course is designed to develop an understanding of advanced operation research and related techniques.*

Module I (12 hours)

Linear Programming: Problem Formulation, Simplex Method, Duality Theory, Dual Simplex Method, Revised Simplex Method, Sensitivity Analysis.

Module II (12 hours)
Network Techniques: Examples of Network Flow Problems, Transportation Problems Assignment Problems, Shortest Path Model, Dijkstra's Algorithm.

Module III (12 hours)
Integer Programming: Introduction, Basic Concepts and Simple Problems: Gomory's Cutting Plane Algorithm, Branch and Bound Method.

Module IV (12 hours)
Goal Programming: Introduction, Basic Concepts, Weights Method, Preemptive Method.
Dynamic Programming: Basic Concepts, Forward and Backward Computational Procedures, Application of Dynamic Programming - Stage coach problem, Cargo loading problem.

Module V (12 hours)
Simulation: Basic Concepts, Discrete and Continuous systems, Generation of Random Numbers, Monte-Carlo Simulation, Simulation software.

Text Books

1. Verma A.P., *Operation Research*, S. K. Kataria & Sons.
2. Pannerselvam R., *Operation Research*, Prentice–Hall of India.

Reference Books

1. Hamdy A Taha, *Operations Research, – An Introduction,* Pearson Education.
2. Ravindran A., *Operations Research – Principles and Practice,* Wiley India (P) Ltd.
3. Srinivasan G., *Operations Research- Principles and Applications,* Prentice–Hall of India.
4. Hillier & Lieberman, *Introduction to Operations Research-Concepts and Cases,* Tata Mcgraw Hill.

Electives IV

ME010 805G01 Industrial Safety

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To develop an understanding of the principles of safety,terminolgies in accident prevention and its theories..*
- *To understand the theory and practice of occupational health,ergonomics and hygiene,principle of fire engineering and fire fighting.*

Module-I (12 Hours)

Development of safety movement: - Need for safety-safety and productivity-planning for safety-planning procedure-safety policy-formulation of safety policy-safety budget-role and qualification of safety professional-safety committees-need, types and functions of committees-safety organizations.

Module II (12 Hours)

Accident prevention: - Basic philosophy of accident prevention-nature and causes of accidents-accident proneness-cost of accidents-accident prevention methods-Domino theory-safety education and training-training methods-motivation and communicating safety-personal protective equipments.

Module III (12 Hours)

Safety management techniques: - Safety inspection-Safety sampling technique-Safety audit-Safety survey-Incident recall technique-Job safety analysis-Damage control-Risk management.

Involvement in safety: - Role of management-role of supervisors-role of workmen- role of unions-role of government

Module IV (12 Hours)

Occupational health and hygiene: - Functional units and activities of occupational health and hygiene-types of industrial hazards-physical, chemical, mechanical, electrical, social, biological, ergonomic and environmental hazards-factors impeding safety-house keeping-hearing conservation programme

Module V (12 Hours)

Industrial fire protection: - Fire chemistry-classification of fires-fire prevention activities-fire risks-fire load -contributing factors to industrial fires-fire detection-industrial fire protection systems.

Text Books:-

1. Heinrich H.W, ‘Industrial accident prevention’, McGraw Hill Company, New York, 1980.

2. Frank P Lees, ‘Loss prevention in process industries’, Vol I, II, III, Butterworth, London, 1980.
3. R.P.Blake, “Industrial Safety”, Prentice Hall of India, New Delhi

Reference books:-

1. “Accident prevention manual for Industrial Operations”, National Safety Council, Chicago, 1989.
2. Brown D.B, “System Analysis and Design for safety”, Prentice Hall, New Jercy.

ME010 805G02 Disaster Management

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

MODULE 1 (12 hours)

Importance of disaster management - Types of emergencies – major industrial disasters – Components of a major hazard control system – identification of major hazard control installations – purpose and procedures – safe operation of major hazard installations – mitigation of consequences – reporting to authorities. Implementation of major hazard control systems – group of experts – training – checklists – inspection – evaluation of major hazards – information to the public – manpower requirements – sources of Information

MODULE 2 (12 hours)

Emergency planning – On-site emergency planning – formulation of the plan and emergency services – Identification of resources – actions and duties – emergency procedure – mock drills. Off-site emergency planning – objectives and elements of off-site plan – role of administrative machinery – role of major hazard works management – role of the local authority. Emergency preparedness at local level – Awareness and preparedness for emergencies at local level (APELL) – The process and its partners.

MODULE 3 (12 hours)

Requirements of emergency plan as per Indian legislations like Factories Act, Manufacture, Storage and Import of Hazardous Chemicals Rules, Chemical Accidents (Emergency planning, Preparedness and Response) Rules-Applications of remote sensing and GIS in disaster management

MODULE 4 (12 hours)

Emergency planning and preparedness in international standards like ISO 14001, OHSAS 18001 and OSHA's Process Safety Management System, Emergency Planning in Seveso II directive – elements of emergency planning in IS : 18001 – Hazardous Materials / Spills Emergencies – contingency plans for road transportation of hazardous chemicals – contingency plans for oil spills in marine environment.

MODULE 5 (12 hours)

Natural Hazards – potentially hazardous natural phenomena – earthquakes – landslides – flooding – cyclones – hazards in arid and semi-arid areas – nature of the hazard – hazard management activities – disaster mitigation – natural hazard prediction – emergency preparedness – disaster, rescue and relief – post disaster rehabilitation and reconstruction – education and training activities – vulnerable elements to be considered in the development planning for natural hazard management .

TEXT BOOKS:

1. Petak, W.J and Atkisson, A.A.: *Natural Hazard Risk Assessment and Public Policy: Anticipating the Unexpected*

2. Frank P Lees, '*Loss prevention in process industries*', Vol I, II, III, Butterworth, London, 1980

REFERENCES:

1. ILO, Geneva: *Major Hazard Control – a Practical Manual.*
2. UNEP, Paris : *APELL - A Process for responding to technological accidents , A Handbook*, Industry & Environment Office., 1998
3. *Accident Prevention Manual for Business and Industry, Vol. I* – National Safety Council, USA.
4. *Oil spill Response : The National Contingency Plan* - Institute of Petroleum, London
5. U.R. Rao : *Space Technology for Sustainable Development*

ME010 805G03 Nano Technology

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

MODULE 1 (12 hours)

Introduction to nano technology – definition – why nano – application in different fields - nano materials, solid state devices – carbon nano tubes: - structure, sythesis, growth mechanisms, properties, carbon nano tubes based nano objects, applications.

MODULE 2 (12 hours)

Nano tribology characterization studies – friction and wear on the atomic scale – nano mechanical properties of solid surface and thin films.

MODULE 3 (12 hours)

Mechanical properties of nano structures: - experimental techniques, indentation and scratch tests, bending tests; experimental results and discussion – nano tribology of ultra thin and hard amorphous carbon films.

MODULE 4 (12 hours)

Nano boundary lubrication – kinetics and energetic in nano lubrication - Nano tribology for data storage application

MODULE 5 (12 hours)

Industrial applications: - micro actuators for dual storage servo systems – MEMS/NEMS materials and applications – mechanical properties of micro machined structures.

TEXT BOOKS:

1. Bhushan – Springer Handbook of Nano technology.

REFERENCE BOOKS:

1. Nano manufacturing Handbook Busnaina CRC press.
2. Pradeep T., IIT Madras - NANO: The Essentials, Tata McGraw Hill

ME010 805 G04 Finite Element Analysis

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To learn the mathematical background of finite element analysis*
- *To solve structural mechanics problems using finite element approach*

Module I (12 hours)

Introduction to FEA:- Brief History, Applications of FEA in various fields, Advantages and disadvantages of FEA.

Review of Theory of Elasticity: - Degrees of freedom, rigid body motion, principle of minimum potential energy, stress and strain at a point, principal stresses, Von-Mises stress.

Basic equations of elasticity: - Stress-strain and, strain displacement relationships, 2D and 3D cases.

Basic steps in finite element problem formulation, importance of discretization, different types of elements, shape functions and stiffness matrices of 1D bar and beam elements.

Module II (12 hours)

Assembly of elements and matrices:- Concept of element assembly, 1D bar element assembly, boundary conditions, 1D problems. Analogous (1-D) problems of torsion and heat conduction.

Co-ordinate systems: - Global and local co-ordinate systems, transformation matrix

Module III (12 hours)

Structural analysis: - Plane truss problems, beam problems

2D finite element formulations: - Three nodded triangular element, four nodded rectangular element, compatibility, four nodded quadrilateral element, eight nodded quadrilateral element.

Variational methods : - Functionals - weak and strong form - essential and non- essential boundary conditions - Principle of stationary potential energy - Rayleigh-Ritz method -simple examples.

Module IV (12 hours)

Higher order Elements:- Quadratic and cubic elements, shape functions, Pascal's triangle, Pascal's pyramid, convergence criterion, Constant Strain triangle element and Linear Strain triangle element- stiffness matrices. Isoparametric elements, natural co-ordinates, area co-ordinates, linear triangle and quadratic triangle elements, Quadrilateral elements.

Module V (12 hours)

Modal analysis: - Eigen vectors and Eigen values, Consistent and lumped mass matrices. Mass matrices for bar element, truss element, beam element, frame element.

Finite element formulation of free vibration problems:- Natural frequencies and mode shapes of longitudinal vibration of bar element, flexural vibrations of beam element.

Structure of a FEA software package: - Pre-processor-solver-Post-processor.

Text Books

1. Hutton David V “Fundamentals of Finite Element Analysis”, TMH 2005
2. Daryl L.Logan, “A first course in the Finite Element Method”, Cengage Learning, Fourth edition, 2007.
3. Robert D.Cook, “Concepts and applications of Finite Element Analysis”, Wiley India, Fourth Edition, 2003.

Reference Books

1. Reddy J.N. “An Introduction to Finite Element Method”, McGraw-Hill, 2000.
2. Krishnamurthy, C.S., “Finite Element Analysis”, Tata McGraw-Hill, 2000.
3. Seshu P “A text book of Finite Element Analysis” PHI,2005

ME010 805 G05 Optimization Methods in Design

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Module 1 (12 hours)

Nonlinear optimization: Introduction - one-dimensional optimization - elimination methods - unrestricted search, exhaustive scare Fibonacci and Golden section methods - Interpolation methods - quadratic and cubic interpolations, direct root methods.

Module 2 (12 hours)

Unconstrained nonlinear optimization: Direct search methods - random search methods - pattern search methods – method of rotating coordinates - descent methods - steepest descent, conjugate gradient, Quasi-Newton, and variable metric methods.

Module 3 (12 hours)

Constrained nonlinear optimization: Direct methods - the complex method, cutting plane method, methods of feasible directions - indirect methods - transformation techniques, interior and exterior penalty function methods.

Module 4 (12 hours)

Non-traditional optimization: Introduction to genetic algorithms, simulated annealing, particle swam optimization and ant colony optimization.

Module 5 (12 hours)

Static Applications: - Structural applications – Design of simple truss members - Design applications – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members – Design of springs.
Dynamic Applications:-Dynamic Applications – Optimum design of single, two degree of freedom systems.
Application in Mechanisms – Optimum design of simple linkage mechanisms.

Text Books

1 Singiresu S. Rao, *Engineering optimization: theory and practice*, 3rd Edition, Wiley Interscience, 1996
2. Kalyanmoy Deb, *Optimization for engineering design*, PHI, New Delhi, 2000
3. David E. Goldberg, *Genetic algorithms in search, optimization and machine learning*, Addison Wesley Pub. Co., 1989
4. Harvey M. Salkin, *Integer programming*, Addison-Wesley Pub. Co., 1975
5. Stephen C. Nash and Ariela Sofer, *Linear and nonlinear programming*, McGraw Hill College Div., 1995

Reference Books

1. Fred Glover, Manuel Laguna, and Fred Laguna, *Tabu search*, Kluwer Academic Publishers, 1997
2. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990.
3. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

ME010 805 G06 Petrochemical Engineering

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

• *To impart the basic concepts of science of petroleum drilling and transportation of oil.*

EXPLORATION AND DRILLING

Module 1 (12 Hours)

Methods of petroleum prospecting and exploration such as geophysical, seismic, etc. - drilling equipments such as rigs, platforms etc - techniques for offshore and onshore operation.

Directional Drilling: Objectives, Types of deflection tools, tool orientation, Directional well profiles, Well path deflection & correction.

Down Hole Motors: Positive displacement motors and Turbo-drills, motor description, Power calculation and applications - Auto-track and verti-track system - Rotary Steerable motors, Geo-steering tools.

Horizontal Well Drilling: Horizontal well objectives and selection, Different profiles, drilling techniques, Mud requirements & characteristics, casing and drill string requirements and completion programs. Problems.

Module 2 (12 Hours)

Slant Hole Drilling: Objectives and selections, Well profiles and applications.

Down the Hole Well Surveying: Well surveying objectives, surveying methods, Surveying Analysis methods and calculations for well coordinates.

Measurements While Drilling: Objectives of MWD/ LWD, MWD tools, Telemetry system and data interpretation.

Directional Drilling Problems and Their Remedies.

Special Methods of Drilling : Aerated drilling, Under-balanced drilling, Overbalanced drilling, HPHT Drilling, Variable pressure regime, Plasma drilling, Electrical Drilling, Top drive drilling, Re-entry drilling, Jet Drilling, Extended reach drilling, Multilateral drilling, Slim hole drilling, coil tubing drilling. Problems.

Drilling economics. Computer Application in Drilling.

DESIGN AND CONSTRUCTION OF PIPELINE

Module 3 (12 Hours)

Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products, Economics of Pipeline transportation.

Design of Pipeline: Factors influencing oil, gas and refined products as pipeline design; Hydraulic surge and water hammer; specific heat of liquids; river crossing; pipe size and station spacing etc.

Theory and different formulae of the flow of fluids in oil/gas pipelines; basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non-Newtonian fluids through pipes; multiphase flow and loop pipelines.

Module 4 (12 Hours)
Construction of pipelines; materials; project specifications; general equipment specifications (Pipes, valves and fittings); Installation of expansion loops and thermodymetric tapping plant. Pigging, Pigging Technology: pig launcher and receiver, intelligent pigging, types of pigs - Corrosion protection and control; Design of cathodic protection system, Pipeline automation. Problems.

Module 5 (12 Hours)
Offshore Pipeline: Design and control of Sag and Over bend; Description of stinger; and Riser, articulated stinger, construction of offshore pipeline, Method of underwater welding.
Hydrates, wax & scale - formation and prevention. Crude conditioning and use of additives to improve flow conditions. City distribution network of oil/gas. Lease and custody transfer.

References:
1. Berger B D, Anderson K E, “Modern Petroleum” Pennwell books
2. Bradley H B, “Petroleum Engineering Handbook”, SPE
3. Cole F W, Reservoir Engineering manual
4. Carl Gatlin, “Petroleum Engineering Drilling and Well Completions” Prentice Hall .
5. Mc Cray and Cole, “Oil Well Drilling Technology” Oklahoma Press

ME010 806 Mechanical Systems Laboratory

List of experiments

1. Test on reciprocating air compressor
2. Tests on blowers and rotary compressors
3. Free vibration analysis
4. Forced vibration analysis
5. Balancing of reciprocating and revolving masses
6. Assembling of mechanical systems
7. Test on refrigeration equipment
8. Test on air conditioning unit
9. Determination of thermal conductivity of conducting and insulating materials
10. Determination of emissivity of surfaces
11. Heat flow through lagged pipes
12. Heat flow through composite walls
13. Determination of overall heat transfer coefficient of heat exchangers
14. Free convection
15. Forced convection
16. Stefan-Boltzmann apparatus
17. Universal governor apparatus
18. Whirling of shafts
19. Gyroscope
20. Friction in hydrodynamic bearings
21. Heat pipe
22. Vortex tube
23. Critical heat flux

ME010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

ME010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.