FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABUS

FOR

B. TECH.
(MECHANICAL ENGINEERING)

(Under Credit Based Continuous Evaluation Grading System)
(SEMESTER: I – IV)
Session: 2015–16

GURU NANAK DEV UNIVERSITY
AMRITSAR

B.Tech. (Mechanical Engineering) 1st Semester
(Under Credit Based Continuous Evaluation Grading System)

Sr. No.	University Course Code	Course Title	L	T	P	Credits
1.	CYL195	Engineering Chemistry	2	1	1	4
2.	MTL101	Mathematics-I	3	1	0	4
3.	ECL115	Electrical Engineering	3	1	0	4
4.	PHL182	Material Science	3	1	0	4
5.	ENL101	Communicative English	2	0	0	2
6.		Elective-I	2	0	0	2
7.	MEP101	Workshop Practices	0	0	2	2
	List of Electives-I					
1.	PBL121	Punjabi (Compulsory) **OR**	2	0	0	
2.	PBL122	Mudhli Punjabi (In lieu of Punjabi Compulsory)	2	0	0	
		Total:	**15**	**4**	**3**	**22**

B.Tech. (Mechanical Engineering) 2nd Semester
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Sr. No.	University Course Code	Course Title	L	T	P	Credits
1.	PHL181	Physics	3	1	1	5
2.	ARL196	Engineering Graphics & Drafting	3	1	0	4
3.	MTL102	Mathematics–II	3	1	0	4
4.	CSL125	Fundamentals of IT & Computer Programming	2	1	1	4
5.	CEL 120	Engineering Mechanics	3	1	0	4
6.		Elective–II	2	0	0	2
		List of Electives–II				
1.	PBL131	Punjabi (Compulsory**) OR**	2	0	0	
2.	PBL132	Mudhli Punjabi (In lieu of Punjabi Compulsory)	2	0	0	
		Total:	**16**	**5**	**2**	**23**

B.Tech. (Mechanical Engineering) 3rd Semester
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S. No.	University Course Code	Subject Group	Course Title	L	T	P	Contact hrs/wk	Credits
1	MTL201	BS	Mathematics-III	3	1	0	4	4
2	MEL 211	ES	Solid Mechanics	3	1	0	4	4
3	MEL 212	ME	Primary Manufacturing	4	0	0	4	4
4	MEL 213	ES	Thermodynamics	2	1	0	3	3
5	MEL 214	ES	Engineering Materials	3	0	0	3	3
6	MEL 215	ES	Machine Drawing	2	0	2	4	3
7	ESL 220	MC-5	*Environmental Studies	3*	0	0	3	3
Practicals								
	ENP 291	HS	Written and Oral Technical Communication Skills	0	0	2	2	1
	MEP 211	ES	Solid Mechanics	0	0	2	2	1
	MEP 212	ME	Primary Manufacturing	0	0	2	2	1
	MEP 214	ES	Engineering Materials	0	0	2	2	1
	MEP 215	ES	Basic Simulation Lab	0	0	2	2	1
	MEP 216	ME	Summer Training**	-	-	-	-	S/US
			TOTAL	**17**	**3**	**12**	**32**	**26**

* Credits of ESL-220 will not be included in SGPA.

** The student should undergo summer training at the end of 2nd Semester. He/ She should clear it satisfactorily.

S–Satisfactory
US–Unsatisfactory

B.Tech. (Mechanical Engineering) 4th Semester
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S. No.	University Course Code	Subject Group	Course Title	L	T	P	Contact hrs/wk	Credits
1	MEL 221	ME	Mechanisms & Machines	3	1	0	4	4
2	MEL 222	ME	CAD & Computer Graphics	3	0	0	3	3
4	MEL 223	ME	Engineering Workshop II	1	0	0	1	1
5	MEL 224	ME	Design of Machine Elements	3	0	0	3	3
6	MEL 225	ME	Fluid Mechanics	3	1	0	4	4
7	MEL 226	ME	Mechanical Measurement and Metrology	3	0	0	3	3
Practicals								
	MEP 221	ME	Mechanisms & Machines	0	0	2	2	1
	MEP 222	ME	CAD & Computer Graphics	0	0	2	2	1
	MEP 223	ME	Engineering Workshop II	0	0	4	4	2
	MEP 224	ME	Design of Machine Elements	0	0	4	4	2
	MEP 225	ME	Fluid Mechanics	0	0	2	2	1
	MEP 226	ME	Mechanical Measurement and Metrology	0	0	2	2	1
			TOTAL	**16**	**2**	**16**	**34**	**26**

NOTE: The students of B.Tech. (Mech. Engg.) 4th Semester are required to undergo Industrial Training four to six weeks after their major examination of 4th Semester in any Industry / Institute of repute. The viva voce will be held along with the viva voce of 5th Semester.

B.Tech. (Mechanical Engineering) 1st Semester
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CYL195 : ENGINEERING CHEMISTRY

L T P
2 1 1

PART – I

Water:

- Common Impurities of water
- Hardness of water: Determination of hardness by Clark's test and complex metric (EDTA) method, Degree of hardness.
- Numerical based on hardness and EDTA method
- Municipal Water Supply: Requisites of drinking water, Steps involved in purification of water, Sedimentation, coagulation, Filtration and Sterilization, Break point Chlorination

Water Treatment:

- Softening of Water: Lime-Soda Method, Permutit (Zeolite) Method and Deionization or Demineralization Method
- Boiler troubles their causes, disadvantages and prevention: Formation of solids (Scale and Sludge), Carry over (Priming and Foaming), Corrosion and Caustic Embrittlement
- Numerical Problems based on Lime-Soda and Zeolite softening methods.

PART – II

Cement:

- Definition, Composition, basic constituents and their significance, Manufacturing of Portland cement by Rotary Kiln Technology
- Chemistry of setting and hardening of cement and role of gypsum

Glass:

- Definition, Properties, Manufacturing of glass
- Types of silicate glasses and their commercial uses
- Importance of annealing in glass making

Refractories:

- Definition, classification, properties, Requisites of good refractory and manufacturing of refractory
- Detailed study of silica and fire clay refractory and their uses
- Seger's (Pyrometric) Cone Test and RUL Test

B.Tech. (Mechanical Engineering) 1st Semester
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PART – III

Polymers:

- Different methods of classification and constituents of polymers
- Plastics: Thermosets and Thermoplasts
- Preparation, Properties and uses of polyethylene, Bakelite, Terylene and Nylon
- Elastomers: Natural rubber, vulcanization, Synthesis Rubbers viz. Buna-S, Buna-N, Butyl-1 and neoprene rubbers.

Lubricants:

- Introduction, classification and uses of lubricants
- Types of lubricants
- Viscosity & Viscosity index, flash and fire point, cloud and pour point, steam emulsification number, precipitation number and neutralization number

Books Recommended:

1. Engineering Chemistry by P.C. Jain & Monica Jain Dhanpat Rai Publishers, New Delhi.
2. Chemical Process Industries by R. Norris Shrive, McGraw Hill Ltd. New Delhi.

PRACTICAL

1. Find the strength of KMnO4 solution.
2. Determine number of water molecules in Mohr salt by titration method.
3. Determine percentage of sodium carbonate in given sample of washing soda.
4. Determine percentage of sodium carbonate and sodium hydroxide in given sample of caustic soda.
5. Determination of total Hardness of Water.
6. Determine the percentage of Ca2+ and Mg2+ in the given sample of water.
7. To determine the molecular weight of a compound by Rast's micro method.
8. Determination of coefficient of viscosity of a given liquid by viscometer.
9. To determine the unknown composition of a given mixture of two liquids by viscosity method.
10. To find the mol. wt. of high polymer by using viscosity measurements.
11. Determination of surface tension of a given liquid by drop number method by stalagmometer.
12. To determine the critical micelle concentration of a soap (sodium laurate) by surface tension measurements.
13. To determine the distribution coefficient of I2 between CCl4 and water.
14. To determine refractive index of a liquid by Abbe's refractometer and hence the specific and molar refraction.
15. Determination of Chlorine in bleaching powder.

Books Recommended:

1. Findlay's Practical Physical Chemistry.
2. Advanced Practical Physical Chemistry by J.B. Jadav.
3. Quantitative Organic Analysis by Vogel.

B.Tech. (Mechanical Engineering) 1st Semester
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MTL- 101: MATHEMATICS – I

L T P
3 1 0

PART – I

Calculus: Partial Derivatives, Euler's theorem on homogeneous functions, Maclaurin's and Taylor's expansions of single and two variables, Maxima and minima of functions of several variables, Lagrangian method of multipliers, Multiple integrals and their use in obtaining surface areas and volumes of solids.

PART – II

Infinite Series: Sequences and sub sequences and their convergence, Cauchy sequence, Infinite series and their convergence, Standard tests for convergence including p-test, Ratio test, Comparison test, Raabe's test, Cauchy Integral test, Cauchy root test, Gauss's test, Absolute Convergence, Alternating series and its convergence, Power Series.

PART – III

Vector Calculus: Scalar and Vector point functions, Differentiation of vectors, Gradient of a scalar field, Divergence and Curl of a vector field and their physical interpretations, Line integral of a vector field, Surface integral of vector field, Volume integral of a scalar field, Green's theorem, stokes theorem, Gauss divergence theorem (without proofs) and their applications.

Books Recommended:

1. Louis A. Pipes: Applied Mathematics for Engineers and Physicists, McGraw Hill Book Company.
2. Kreyszig: Engineering Mathematics, Wiley Eastern Ltd.
3. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. Murray & Spiegel, Vector Analysis, Schaum Publication Co.

B.Tech. (Mechanical Engineering) 1st Semester
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ECL115: ELECTRICAL ENGINEERING

L T P
3 1 0

PART – I

1. **Electricity:** A brief review of various applications of electricity, difference between AC and DC, PARTs of voltage, current and resistance, concept of electromagnetic induction and production of alternating e.m.f. – single phase and poly phase, concept of 3 phase system star and delta connections, voltage and current relations (formula only).
2. **Power Supply:** A brief review of special features of the power supply system, power-station, transmission, distribution lines, service main, domestic and industrial wiring installation.
3. **Circuit Analysis:** A brief review of DC and single phase AC circuits. Three phase AC circuits, phasor representation, star–delta transformation, concept of balanced and unbalanced three phase circuits, measurement of power and power factor in three phase balanced circuits, AC circuits (L.R.C.) solution.
4. **Electrical Machinery:** Transformers, its working principle, types of transformers and their applications, performance losses, efficiency and voltage regulation open circuit and short circuit tests on a transformer, auto transformer.

PART – II

5. **DC Motors:** Force and EMF production, methods of excitation in DC machines, various types, characteristic and application of DC shunt and series motors.
6. **Phase Induction Motor:** Construction and type of three phase induction motors, equivalent circuits, application of different types of induction motors, starters and protective devices used for motors.
7. **Phase Synchronous Machines:** Principle of working and construction of alternators and synchronous motors.
8. **Single Phase Induction Motors:** Types and construction, their working principle, starting of single phase motor, application of single phase motors.

PART – III

9. **Control and Protection:** Control mechanism, principle and application of servo motors, protection devices for wiring installation and motors – fuses MCB, LCB, relays.
10. **Cables:** Types of cables, construction of LT and HT cables, laying of cables, selection of cables.
11. **Earthing and Grounding:** Need, types, Indian Electricity Rules, use of meggar and earth tester for measurement of earth resistance.

Books Recommended:

1. Principles of Electrical Engineering by Gupta BR; S. Chand and Company, New Delhi.

2. Electrical Technology by Hughes Edward; The English Language Book Society and Longmans Group Limited, London.

3. Electrical Machines by Bhattacharya SK; Tata McGraw Hill, Delhi.

4. Experiments in Basic Electrical Engineering by Bhattacharya SK and Rastogi KM; New Age International, New Delhi.

5. Experiments in Electrical Engineering by Bhatnagar US; Asia Publishing House, Bombay.

6. Advanced Electrical Technology by Cotton H; Isaac Pitmans and Sons Limited, London.

7. Electrical Engineering – Basic Technology by Hubschar; Deutsche Gesllschaft Fur Technische Zusammenabelt (GTZ) GMBH.

8. Basic Electrical Engineering by T.K. Naggarkar & Ms. Sakhija Seventh Edition 2008, Oxford University Press.

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PHL182: MATERIAL SCIENCE

L	T	P
3	1	0

PART-I

Structure-property relationship; crystal system, close packing, crystal planes and directions; Miller indices; Determination of crystal structure using X-Ray diffraction.

PART-II

Phase diagram; Unary and binary; Lever rule; solid solutions; steel types; non-ferrous materials and alloys.

PART-III

Elastic and Plastic deformation; Effect of temperature, impurity and grain size on strength of materials; Ferroelectric, dielectric, piezoelectric and pyroelectric materials.

Recommended Books:

1. Materials Science and Engineering by WD Callister Jr. (John Wiley & Sons Inc., Eighth Edition)
2. Materials Science and Engineering: A First Course by V Raghvan (Prentice-Hall of India Pvt. Ltd.).

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ENL–101: Communicative English–I

Time: 3 Hrs. **L T P**
2 0 0

Objective: To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas. This course will prepare students to read a variety of texts and also to communicate more effectively through writing. The course will also pay special attention to vocabulary building.

Prescribed Text books:

1. *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.
2. *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

Course Contents:

1. Reading and Comprehension Skills:

Students will be required to read and comprehend the essays in Unit 1 and 2 of the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition. They will be required to answer the questions given after each essay.

2. Developing Vocabulary and using it in the Right Context:

The students will be required to master "Word List" and "Correct Usage of Commonly Used Words and Phrases" from the Chapter "Vocabulary" in the book *The Written Word.*

3. Writing Skills

Students will be required to learn "Report Writing" and "Letter Writing" as in the book *The Written Word.*

Students will be required to write long essays based on the prescribed text book *Making Connections: A Strategic Approach to Academic Reading.*

Minor 1:

Syllabus to be covered:
1. Unit 1 from *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.
2. Report Writing from *TheWritten Word.*

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Suggested Paper Pattern:

1. Report Writing (8 marks)
2. Short answer type questions from Unit 1 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks)
3. Essay type question from Unit 1 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks)

Minor 2:

Syllabus to be covered:

1. "Word List" from the Chapter "Vocabulary" in the book *The Written Word.*
2. Unit-2 from the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.

Suggested Paper Pattern:

1. Word List from the Chapter "Vocabulary" in the book *The Written Word* (8 marks)
2. Short answer type questions from Unit 2 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks)
3. Essay type question from Unit 2 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks)

Suggested Paper Pattern for Major Exam:

1. Letter Writing as prescribed in *The Written Word* /1 out of 2 (10 marks)
2. Short answer type questions from Unit 1,2 of *Making Connections: A Strategic Approach to Academic Reading* (14 marks)
3. "Word List" and "Correct Usage of Commonly Used Words and Phrases" from the Chapter "Vocabulary" present in the book *The Written Word.* (10 marks)
4. Essay type question from Unit 1,2 of *Making Connections: A Strategic Approach to Academic Reading* 1 out of 2 (8 marks)
5. Report Writing from *The Written Word* (8 marks)

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MEP101: Workshop Practices

L T P
0 0 2

1. Carpentry Shop:
a) Study of tools & operations and carpentry joints.
b) Simple exercise using jack plane.
c) To prepare half-lap corner joint, mortise & tennon joints.
d) Simple exercise on wood working lathe.

2. Fitting (Bench Working) Shop:
a) Study of tools & operations
b) Simple exercises involving fitting work.
c) Make perfect male-female joint.
d) Simple exercises involving drilling / tapping / dieing.

3. Black Smithy Shop:
a) Study of tools & operations
b) Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.

4. Welding Shop:
a) Study of tools & operations of Gas welding & Arc welding.
b) Simple butt and Lap welded joints.
c) Oxy-acetylene flame cutting.

5. Sheet-metal Shop:
a) Study of tools & operations.
b) Making Funnel complete with soldering.
c) Fabrication of tool-box, tray, electric panel box etc.

6. Machine Shop:
a) Study of Single point cutting tool, machine tools and operations.
b) Plane turning.
c) Step turning.
d) Taper turning.
e) Threading.

7. Foundry Shop:
a) Study of tools & operations
b) Pattern making.
c) Mould making with the use of a core.
d) Casting

8. **Electrical and Electronics Shop:**
a) Study of tools & operations

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(Elective – I)

Punjabi (Compulsory)
PBL–121: pj`bl l`zml

p`T–km Eq p`T–psqk-

Credits: 2–0–0

(I) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) grmK isG ms`iPr : gt`r
(E) sj`n isG : pT`x dl Dl
(e) krq`r isG dgl : acl Efl v`ll grg`bl
(kh`xl–s`r, ivS`–vsq, kh`xl–kl`, kh`xlk`r)

2. grmKl ErQgr`Pl dl jgq, (plql; mh`rnl; ibdl, itpl q EDk); ivr`m icn, Sbd jV (SD–ESD)

(II) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) sqK isG Dlr : s-Jl kD
(E) klvq isG ivrk : aj`V
(e) mihdr isG srn` : jQd`r mkd isG
(kh`xl–s`r, ivS`–vsq, kh`xl–kl`, kh`xlk`r)

2. lK rcn` (jlvnl–prk, sm`jk Eq clq iviSE- aq):
10 lK ilKv`ax (kl`s ivc Eq Gr lel EiBE`s)

(III) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) pm pk`S : m`V` bd`
(E) glz`r isG sD : klCx
(e) mhn Bf`rl : Gtx`
(s) virE`m isG sD : dldl
(kh`xl–s`r, ivS`–vsq, kh`xl–kl`, kh`xlk`r)

2. pr` pV k pSn- d aqr dx`
(E`qm En`qm psqk d kh`xl B`g ivcl 15 pirE- d EiBE`s krv`ax)

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(Elective – I)

Mudhli Punjabi
PBL–122: ਮੁੱਢਲੀ ਪੰਜਾਬੀ
(In lieu of Punjabi Compulsory)

2-0-0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ,
   ਗੁਰਮੁਖੀ ਲਿਪੀ
   ਗੁਰਮੁਖੀ ਲਿਪੀ : ਬਣਤਰ ਅਤੇ ਤਰਤੀਬ

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ
   ਸੁਰ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ
   ਵਿਅੰਜਨ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ

3. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ
   ਸਾਧਾਰਨ ਸ਼ਬਦ
   ਇਕ ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਾਮਕਰਣ ਅਤੇ ਸੰਖੇਪ ਜਾਣ ਪਛਾਣ, ਗੁਰਮੁਖੀ ਲਿਪੀ: ਨਾਮਕਰਣ, ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ; ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ, ਸੁਰ ਵਾਹਕ (ਓ ਅ ਏ), ਲਗਾਂ ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ।

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ; ਸੁਰਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ (ਲਘੂ–ਦੀਰਘ ਸੁਰ); ਸੁਰ ਅਤੇ ਲਗਾਂ ਮਾਤਰਾਂ; ਵਿਅੰਜਨਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣਾਂ (ਹ, ਰ, ਵ) ਦਾ ਉਚਾਰਨ ; ਲ ਅਤੇ ਲ਼ ਦਾ ਉਚਾਰਨ; ਭ, ਧ, ਢ, ਝ, ਘ ਦਾ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣਾਂ ਦਾ ਉਚਾਰਨ।

3. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ: ਸਾਧਾਰਨ ਸ਼ਬਦ; ਇਕੱਲਾ ਸੁਰ (ਜਿਵੇਂ ਆ); ਸੁਰ ਅਤੇ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਆਰ); ਵਿਅੰਜਨ ਅਤੇ ਸੁਰ (ਜਿਵੇਂ ਪਾ); ਵਿਅੰਜਨ ਸੁਰ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਪਾਰ); ਕੌਸ਼ਗਤ ਸ਼ਬਦ (ਜਿਵੇਂ ਘਰ, ਪੀ); ਵਿਆਕਰਣਕ ਸ਼ਬਦ (ਜਿਵੇਂ ਨੂੰ, ਨੇ); ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾਫ਼1; ਲਿੰਗ–ਪੁਲਿੰਗ, ਇਕ ਵਚਨ–ਬਹੁ ਵਚਨ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–1: ਖਾਣ–ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁੱਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ ਆਦਿ ਨਾਲ ਸੰਬੰਧਿਤ।

B.Tech. (Mechanical Engineering) 2nd Semester
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PHL181: PHYSICS

L T P
3 1 1

PART-I

Quantum Mechanics: De Broglie's hypothesis of matter waves, Phase and group velocities, Uncertainty principle, Schroedinger equation: Time dependent form, Expectation value, Operators, Steady State Form, Eigen values and Eigen functions, Particle in a box; Tunnel effect.

PART-II

Statistical Mechanics: (Maxwell- Bolzmann) statistics; Bose-Einstein statistics; Rayleigh-Jeans, Planck's and Wiens displacement and Stefan-Bolzmann Laws; Einstein formula for specific heat, Bose condensation; Fermi-Dirac statistics: Free electrons in metal, Fermi energy and electron distribution.

PART-III

Lasers: Einstein coefficients, population inversion, optical resonators, Gas lasers (He-Ne and CO_2), Solid State Lasers (Three and Four level systems).

PRACTICALS

1. To find the capacitance of a capacitor using flashing and quenching of neon lamp.
2. To determine the capacitance of a capacitor by discharging it through a voltmeter.
3. To measure the low resistance using Carey-Foster's bridge.
4. To find the frequency of AC supply using an Electric vibrator.
5. To find the impedance of an AC Circuit containing R, L and C in series.
6. To study the resonance in series LCR circuit for different R-value and calculate Q-value.
7. To study the phase relationships using impedance triangle for LCR circuit and calculate impedance.

Books Recommended:-

1. Concepts of Modern Physics. Arthur Beiser, (Tata McGraw-Hill, Sixth Edition 2003).
2. Lasers & Nonlinear optics. B.B. Laud (New Delhi, India: Wiley Eastern 1991).

B.Tech. (Mechanical Engineering) 2nd Semester
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ARL196: ENGINEERING GRAPHICS & DRAFTING

L T P
3 1 0

Course Objectives:

A. Increase ability to communicate with people
B. Learn to sketch and take field dimensions.
C. Learn to take data and transform it into graphic drawings.
D. Learn basic engineering drawing formats
E. Prepare the student for future Engineering positions

Course Outcomes:

1. Student's ability to hand letter will improve.
2. Student's ability to perform basic sketching techniques will improve.
3. Students will be able to draw orthographic projections and sections.
4. Student's ability to use architectural and engineering scales will increase.
5. Students ability to produce engineered drawings will improve
6. Student's ability to convert sketches to engineered drawings will increase.
7. Students will become familiar with office practice and standards.
8. Students will develop good communication skills and team work.

PART – I

Drawing Techniques: Various types of lines, principles of dimensioning, size and location of dimensions, symbols, conventions scales (plane and diagonal) and lettering as per IS Code SP–46 of practice for general engineering drawings. Practice of drawing various types of lines and dimensioning exercises. Drawing exercises pertaining to symbols, conventions. Exercise on lettering techniques: Free hand printing and numerals in 3, 5, 8 and 12 mm sizes vertical and inclined at 75 ; instrumental lettering in single stroke.

Projection of Points, Lines and Planes: First angle and third angle projections, concept of horizontal and vertical planes, Projection of points and lines, True length, Horizontal and vertical traces, Projection of Planes, Traces of Planes, Auxiliary planes. Practice exercises on projection of points, lines and planes.

Projection and Selection of Solids: Projection of solids such as Prisms, Pyramids, Cylinders, Cones, Spheres, Auxiliary View. Principles of sectioning, types of sectioning, section lines, cutting plane lines. Practice on projection of solids.

PART – II

Isometric Projection: Exercises on isometric views.

Orthographic Projections: Orthographic views, Missing views. Exercises on identification of missing views. Practice on orthographic projections.

Practice of free hand sketching of different types of objects.

B.Tech. (Mechanical Engineering) 2nd Semester
(Under Credit Based Continuous Evaluation Grading System)

PART – III

Intersection and Development of Surfaces: Intersection of cylinders, cones and Prisms, Axis of solids being vertical or horizontal. Development of surfaces of truncated cylinders, cones and prisms. Exercises on intersection of solids – cylinder and cylinder, cylinder and cone, prism and prism, prism and cone, sphere with cylinder. Exercises involving development of surfaces (Y–Piece, Hopper, Tray and truncated pieces).
Fasteners: Introduction to temporary and permanent fasteners riveted and welded joints, types screw threads, conventional symbols for internal and external threads. Exercises involving drawing of bolts, nuts, studs and locking devices.
Symbols and Conventions: Symbol and conventions pertaining to relevant engineering disciplines.

Books Recommended:

1. Engineering Drawing by PS Gill, SK Kataria and Sons, Ludhiana.
2. Engineering Drawing by NK Bhatt.
3. Text Book of Engineering Drawing by R.K. Dhawan, S. Chand & Company Ltd.
4. Engineering and Teaching Drawing by Earl D. Black.

B.Tech. (Mechanical Engineering) 2nd Semester
(Under Credit Based Continuous Evaluation Grading System)

MTL102 : MATHEMATICS – II

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PART – I

Differential Equations: Exact differential Equation, Higher order linear Differential equations, ODE's with constant coefficients.
Laplace Transforms: Laplace transforms, Properties of Laplace transforms, Laplace transform of derivatives and differentiation theorem, Integration theorem, Laplace transform of Integrals, Inverse Laplace transform, Formulas for obtaining inverse Laplace transforms, Convolution theorem, The second shifting property.

PART – II

Fourier Series and Fourier Transform: Fourier Series expansion, Fourier series for even and odd functions, half range series, harmonic functions, Modulation theorem, Shifting properties, convolution theorems, sine and cosine transforms, Fourier transform of derivatives and integrals, inverse Fourier transform, Applications to PDE's and ODE's.

PART – III

Complex Analysis: De Moivre's theorem with applications, Analytic functions, Cauchy-Riemann equations, Laplace equation, Cauchy's integral theorem, Cauchy's integral formula (without proofs), Taylor series and Laurent series (without proofs), Residues and their application in evaluating real improper integrals.

Books Recommended:

1. Louis A. Pipes: Applied Mathematics for Engineers and Physicists, McGraw Hill Book Company.
2. Kreyszig: Engineering Mathematics, Wiley Eastern Ltd.
3. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi.

B.Tech. (Mechanical Engineering) 2nd Semester
(Under Credit Based Continuous Evaluation Grading System)

CSL125 : FUNDAMENTALS OF IT AND COMPUTER PROGRAMMING

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PART – I

Block diagram of Computer, Associated peripherals, Memories – RAM, ROM, Secondary Storage Devices, Classification of Computers and Languages, Introduction to Compilers, Interpreter and Assemblers, Introduction of various operating system with their file system, Features of DOS, Internal and External commands of DOS, Introduction to Windows and Linux.

PART – II

Algorithm and Flowchart, Introduction to C language, Various Data Types- Basic, Derived, user defined and void, Operators, Expressions, Variable, Constant, Header files, Formatted and unformatted input and output statements, Control and conditional statements. Arrays.

PART – III

String Handling, Functions- call be value and call by references, Structures and Unions, Array of structure, Pointers, Dynamic memory allocation using mallooc and calloc functions, File Handling, Modes of file handling, File handling Input and Output statements.

PRACTICAL

- Looking for directories and files under DOS.
- Changing drives, searching for files, looking at files extensions and size of files.
- Deleting and saving files, protecting and unprotecting file.
- Familiarizing with windows, closing, maximizing, shifting icons, ordering icons, changing the size of windows, moving windows.
- File manager to view the files, transfer files from directories/devices.
- Exercises (at least fifteen) involving assignment, looping, functions, arrays, structure, string, pointers and files in C.

Recommended Books:

1. Computers Today by Sanders.
2. Fundamentals of Computers TTTI Publication.
3. DOS Instant Reference by Harvey and Nelson.
4. Programming with ANSI and Turbo C 2nd edition – Kamthane, Pearson Publication
5. Let US C 8th edition – Yashwant Kanetkar- Infiniti Science Press
6. Mastering Turbo C by Brottle Stan Kelly.

B.Tech. (Mechanical Engineering) 2nd Semester
(Under Credit Based Continuous Evaluation Grading System)

CEL 120: ENGINEERING MECHANICS

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PART – I

Introduction: Force system, dimensions and PARTs in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems.

PART – II

Truss and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems. Centroid , Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects. Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems.

PART – III

Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem. Shear Force and Bending Moment Diagram for statically determinant beams Classification of beams, types of loads, shear force and bending moment calculation and their graphical presentation, point of inflection, problem.

Books Recommended:

1. Engineering Mechanics – Irving H. Shames, PHI Publication

2. Engineering Mechanics – U.C.Jindal, Galgotia Publication

B.Tech. (Mechanical Engineering) 2nd Semester
(Under Credit Based Continuous Evaluation Grading System)
(Elective – II)

Punjabi (Compulsory)
PBL–131: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ

p`T–km Eq p`T psqk~

Credits: 2–0–0

(I) 1. E`qm En`qm (sp. virE`m isG Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT~ ilK kvl :

(a) B`el vlr isG
(E) p: prn isG
(e) p: mhn isG
(kivq`–s`r, ivS`–vsq, k`iv–kl`, kvl)

2. pj`bl Sbd bxqr : D`q/ml, vDqr (Egqr, ipCqr, ivalqpq Eq rp~qrl), sm`s |

(II) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kvl :

(a) Eimq` plqm
(E) f`. hrBjn isG
(e) iSv km`r bt`lvl
(kivq`–s`r, ivS`–vsq, k`iv–kl`, kvl)

2. pr` rcn` : kl`s ivc 10 iviSE~ (siBE`c`rk, D`rimk Eq r`jnlqk) q pr` rcn` d EiBE`s krv`ax |

(III) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kvl :

(a) f`. jsvq isG nkl
(E) f`. jgq`r
(e) f`. srjlq p`qr
(s) p`S
(kivq`–s`r, ivS`–vsq, k`iv–kl`, kvl)

2. mh`vr q EK`x (EK`x q mh`vr` kS ivc) 200 mh`virE~ Eq 100 EK`x~ n v`k~ ivc vrqx d EiBE`s krv`ax (kl`s ivc q Gr lel) |

B.Tech. (Mechanical Engineering) 2nd Semester
(Under Credit Based Continuous Evaluation Grading System)
(Elective – II)

Mudhli Punjabi
PBL–132: ਮੁੱਢਲੀ ਪੰਜਾਬੀ
(In lieu of Punjabi Compulsory)

2–0–0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ
   ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ
   ਬਹੁ–ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

2. ਪੰਜਾਬੀ ਵਾਕ–ਬਣਤਰ
   ਸਾਧਾਰਨ–ਵਾਕ : ਕਿਸਮਾਂ
   ਸੰਯੁਕਤ–ਵਾਕ : ਕਿਸਮਾਂ
   ਮਿਸ਼ਰਤ–ਵਾਕ : ਕਿਸਮਾਂ

3. ਪ੍ਰਕਾਰਜੀ ਪੰਜਾਬੀ
   ਚਿੱਠੀ ਪੱਤਰ
   ਪੈਰ੍ਹਾ ਰਚਨਾ
   ਸੰਖੇਪ ਰਚਨਾ
   ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ : ਸੰਯੁਕਤ ਸ਼ਬਦ; ਸਮਾਸੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਲੋਕ ਸਭਾ); ਦੋਜਾਤੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਕਾਲਾ ਸਿਆਹ); ਦੋਹਰੇ ਸ਼ਬਦ/ਦੁਹਰਰੁਕਤੀ (ਜਿਵੇਂ ਧੂੜ੍ਹ ਧਾੜ੍ਹ/ਭਰ ਭਰ), ਮਿਸ਼ਰਤ ਸ਼ਬਦਾਂ ਦੀ ਬਣਤਰ/ਸਿਰਜਨਾ; ਅਗੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਉਪ ਭਾਸ਼ਾ), ਪਿਛੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਰੰਗਲਾ), ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ–2: ਪੜਨਾਵੀਂ ਰੂਪ, ਕਿਰਿਆ/ਸਹਾਇਕ ਕਿਰਿਆ ਦੇ ਰੂਪ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–2: ਮਾਰਕੀਟ/ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਿਤ।

2. ਪੰਜਾਬੀ ਵਾਕ–ਬਣਤਰ : ਕਰਤਾ ਕਰਮ ਕਿਰਿਆ; ਸਾਧਾਰਨ ਵਾਕ, ਬਿਆਨੀਆ, ਪ੍ਰਸ਼ਨਵਾਚਕ, ਆਗਿਆਵਾਚਕ, ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਵਾਕਾਂ ਦੀਆਂ ਕਿਸਮਾਂ; ਸੁਤੰਤਰ ਅਤੇ ਅਧੀਨ ਉਪਵਾਕ; ਸਮਾਨ (ਤੇ/ਅਤੇ) ਅਤੇ ਅਧੀਨ (ਜੋ/ਕਿ) ਯੋਜਕਾਂ ਦੀ ਵਰਤੋਂ; ਪੰਜਾਬੀ ਵਾਕਾਂ ਦੀ ਵਰਤੋਂ : ਵਿਭਿੰਨ ਸਮਾਜਕ/ਸਭਿਆਚਾਰਕ ਪ੍ਰਸਥਿਤੀਆਂ ਦੇ ਅੰਤਰਗਤ; ਘਰ ਵਿਚ, ਬਾਜ਼ਾਰ ਵਿਚ, ਮੇਲੇ ਵਿਚ, ਸ਼ੋਪਿੰਗ ਮਾਲ/ਸਿਨਮੇ ਵਿਚ, ਵਿਆਹ ਵਿਚ, ਧਾਰਮਿਕ ਸਥਾਨਾਂ ਵਿਚ, ਦੋਸਤਾਂ ਨਾਲ ਆਦਿ।

3. ਇਸ ਯੂਨਿਟ ਵਿਚ ਚਿੱਠੀ ਪੱਤਰ (ਨਿੱਜੀ/ਦਫ਼ਤਰੀ/ਵਪਾਰਕ), ਪੈਰਾ ਰਚਨਾਂ, ਸੰਖੇਪ ਰਚਨਾ ਅਤੇ ਅਖਾਣ ਮੁਹਾਵਰਿਆਂ ਦੀ ਵਰਤੋਂ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀ ਦੀ ਭਾਸ਼ਾਈ ਯੋਗਤਾ ਨੂੰ ਪਰਖਿਆ ਜਾਵੇਗਾ।

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B.Tech. (Mechanical Engineering) 3rd Semester
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MTL 201: MATHEMATICS-III

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UNIT – I

Probability: Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and bayes theorem.

Random Variables: Random Variables, probability mass function, probability density function, cumulative distribution function, function of random variable. Two and higher dimensional random variables, joint distribution, marginal and conditional distributions, Stochastic independence.

UNIT – II

Expectation: Mathematical expectations and moments, moment generating function and its properties.
Probability Distributions: Binomial, Poisson, Uniform, Exponential, Gamma, Normal distribution, t–distribution, chi–square distribution, F–distribution.

UNIT – III

Uniform Pseudo random number generation and random variable generation, Generating random variate from standard statistical distribution (discrete and continuous distribution), Monte– Carlo integration.

Books Recommended:

1. Hogg, RV, Mckean, JW and Craig, AT: Introduction to Mathematical Statistics.
2. Gupta, SC and Kapoor, K: Fundamentals of Mathematical Statistics, Sultan Chand & Co.
3. Rubinstein, R.Y.: Simulation and the Monte Carlo Method, John Wiley.
4. Probability and Statistics with Reliability by KS Trivedi, Prentice Hall.

B.Tech. (Mechanical Engineering) 3rd Semester
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MEL 211: Solid Mechanics

L	T	P
3	1	0

Course Objectives and Course Outcomes: To familiarize the students with the fundamentals of deformation, stresses, strains in structural elements. Know the concepts of stress and strain, Analyze the beam of different cross sections for shear force, bending moment, slope and deflection, Understand the concepts necessary to design the structural elements and pressure vessels, Understand the concept of torsion

1: Simple Stresses and Strains- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Hooke's law, Young's modulus, Poisson's ratio, stress at a point, stresses and strains in bars subjected to axial loading, Modulus of elasticity, stress produced in compound bars subjected to axial loading. Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound walls.

2: Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

3: Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

4: Theory of bending stresses- Assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel sections, Composite beams, bending and shear stresses in composite beams.

5: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

6: Torsion - Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity., Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.

7: Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

8: Columns and Struts- Columns under uni-axial load, Buckling of Columns, Slenderness ratio and conditions. Derivations of Euler's formula for elastic buckling load, equivalent length. Rankine Gordon's empirical formula.

Text/Reference Books:

1. Pytel A H and Singer F L, *"Strength of Materials"*, Harper Collins, New Delhi.
2. Beer P F and Johston (Jr) E R, *"Mechanics of Materials"*, SI Version, McGraw Hill, NY.
3. Popov E P, *"Engineering Mechanics of Solids"*, SI Version, Prentice Hall, New Delhi.
4. Timoshenko S P and Young D H, *"Elements of Strength of Materials"*, East West Press, New Delhi.
5. Shames, I. H., Pitarresi, J. M., "*Introduction to Solid Mechanics*," Prentice-Hall, NJ.
6. NPTEL courses, *http://nptel.iitm.ac.in/courses.php*, web and video courses on Strength of Materials by Prof. Sharma, S. C., and Prof. Harsha, S. P.

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MEL 212: Primary Manufacturing

L	T	P
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Course Objectives and Course Outcomes: This course is designed to provide students with an overview of a wide variety of manufacturing processes for processing of engineering materials. The students will learn principles, operations and capabilities of various metal casting and metal joining processes. They will also learn about the defects, their causes and remedies in these processes. Upon completion of the course, the students should have the ability to understand the importance of the manufacturing processes and to select a suitable metal casting and metal joining processes to fabricate an engineering product.

1: General Introduction-Manufacturing; definition and broad classification with typical examples of applications.

2: Casting -Introduction; History of the technology; Definition and major classification; Casting materials, Sand mould casting:- Basic principles with simple examples of a solid casting and a hollow casting. Patterns; types, material and design including pattern allowances; Moulding sands; composition, preparation, properties and testing; Core; Purpose, definition, materials, preparation and applications; Design of gating system; pouring basin, sprue, runner and risers; Advantages, limitations and applications of top gate, bottom gate, parting gate and step gate; Estimation of pouring time for top gate and bottom gate type moulds. Foundry equipment and furnaces. Melting, pouring and solidification. Principles, method, relative advantages and applications of floor mould casting, shell mould casting, pit mould and loam mould casting CO2 mould casting; centrifugal casting (pure, semi and centrifuging types) investment casting including mercasting ; Permanent mould casting. Die casting; types, methods, relative advantages and applications Slush casting; principle and use, Casting defects; types, causes and remedy

3: Forming Processes - Introduction; General principles; major classification with typical examples ; Hot working and cold working; principle, purpose, relative advantages and applications. Forging:-Definition and classification giving few example of application; work materials different forging operations, tools and equipment ; Smithy, drop forging and press forging (pressing) methods and use; Forging dies ;types, materials and design. Rolling:- Introduction ; basic principles and general applications; Characteristics and applications of hot rolling and cold rolling; various rolling processes and applications and rolled products; Roll pass design for different products Wire drawing and Extrusion:- Basic principles and requirements; Classification, methods and applications; Work materials and products; Press tool works; Basic principles, system, operations and applications.

Shearing; Parting, notching, blanking and piercing. Cupping (drawing) and deep drawing. Design of blanks for any shearing and cupping operation. Estimation of forces and power required for shearing and cupping operations. Coining and embossing; basic principle and methods. Other forming processes:- Principles, methods, essential requirements and applications of Spinning and flow turning; Bulging; Hydro forming; Magneto forming; Explosive forming.

4: Welding- Introduction: Major classes of joining; Mechanical joining; temporary, semi- permanent and permanent Giving examples; Welding; Brazing and soldering; Adhesive bonding; Welding in Liquid state. Fusion welding: - Introduction; basic principle, definition and major classification; characteristics and applications of different fusion welding processes using different heat-sources. Heat source:-chemical; gas welding; thermit welding; Heat source:- electrical; Arc welding; Manual arc welding; Submerged arc welding; TIG and MIG; Induction welding; Plasma arc welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Laser beam welding and electron beam welding. Solid state welding: - Principles. Methods, requirements and application of the different types; Solid state welding in hot condition; Forge welding; Friction welding; Diffusion welding; Solid state welding in cold condition; Ultrasonic welding. Pressure welding. Explosive welding. Welding defects; Types, causes, effects and remedy.

Text /Reference Books:

1. Rao.P.N. 2001. Manufacturing technology: foundry, forming and welding: McGraw-Hill.
2. Ghosh, A., & Mallik, A. K. 1986. Manufacturing science: Ellis Horwood.
3. Kalpakjian, S., & Schmid, S. R. 2008. Manufacturing processes for engineering materials: Pearson Education.
4. Campbell, J. S. Principles of manufacturing materials and processes: Tata McGraw-Hill
5. Date. P.P. *Introduction to manufacturing processes;* Jaico Publishing House
6. NPTEL courses, *http://www.nptel.iitm.ac.in/courses.php?disciplineId=112* web and video resources on Manufacturing Processes - I.

B.Tech. (Mechanical Engineering) 3rd Semester
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MEL213: Thermodynamics

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Course Objectives and Course Outcomes: This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components. The students will be able to identify, track and solve various combustion problems and evaluate theoretically the performance of various components involved in steam power plants and internal combustion engines.

1: Basic Concepts- Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases.

2: First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow
3: Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigeration and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, reversible steady-flow work, minimizing the compressor work, isentropic efficiencies of steady- flow devices, and entropy balance.
Energy - a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, energy change of a system, energy transfer by heat, work, and mass, the decrease of energy principle and energy destruction, energy balance: closed systems and control volumes energy balance.

4: Properties of Pure Substance- Properties of pure substances. Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces. Thermodynamic properties of steam. Calculations of work done and heat transfer in non- flow and flow processes.

5: Power Cycles- Vapour and combined power cycles, including the Carnot vapor cycle, Rankine cycle: the ideal cycle for vapor power, the ideal reheat and regenerative and the second-law analysis of vapour power cycles. Gas power cycles, including basic considerations in the analysis of power cycles, the Carnot cycle and its value in engineering, , an overview of reciprocating engines, air standard assumptions ,gasoline engine Otto cycle, diesel engine cycle, gas-turbine Brayton cycle, and the second-law analysis of gas power cycles.

6: Ideal and Real Gases and Thermodynamic Relations- Gas mixtures – properties ideal and real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius Clapeyron equations, Joule – Thomson coefficient.

7: Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling. Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables. Refrigeration cycles, including refrigerators and heat pumps, the ideal reversed Carnot vapour- compression refrigeration cycle, actual vapor- compression refrigeration cycles, heat pump systems, gas refrigeration cycles, and absorption refrigeration systems.

Text/ Reference Books:

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
2. Cengel, „Thermodynamics – An Engineering Approach' Tata McGraw Hill, New Delhi.
3. Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. *Fundamentals of thermodynamics*: Wiley.
4. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. *Fundamentals of Engineering Thermodynamics*: John Wiley & Sons.
5. Jones, J. B., & Dugan, R. E. *Engineering thermodynamics*: Prentice Hall.
6. Potter, M. C., & Somerton, C. W. *Schaum's Outline of Thermodynamics for Engineers,* McGraw- Hill.

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MEL 214: ENGINEERING MATERIALS

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Course Objectives and Course Outcomes:
This course is designed to develop fundamental concepts of crystallography, phase transformation and heat treatment processes. The students will learn the atomic structure of metals, imperfections, diffusion mechanisms and theories of plastic deformation. They will also understand equilibrium diagrams, time-temperature transformation curves and heat treatment processes. Upon completion of the course, the students will be able to understand the concepts of crystal structure, microstructure and deformation. They will also be able to understand the phase diagrams which are useful for design and control of heat treating processes.

1: Basic Crystallography- Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices. Crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number. Frank Reed source of dislocation Elastic & plastic modes of deformation, slip & twinning, strain hardening, seasons cracking, Bauschinger's effect, yield point phenomenon, cold/hot working, recovery, re-crystallization, and grain growth, strengthening of metals.

2: Constitution of Alloys and Phase Diagrams- Constitution of alloys – Solid solutions - substitutional and interstitial. Phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions. Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

3: Heat Treatment- Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and tempering of steel. Isothermal transformation diagrams –cooling curves superimposed on I.T. diagram CCR Hardenability, Jominy end quench test – Austempering, martempering. Case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

4: Ferrous and Non Ferrous Metals- Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA. Gray, White malleable, spheroidal -Graphite - alloy cast-iron. Copper and Copper alloys – Brass, Bronze and Cupronickel. Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys.

5: Non-Metallic Materials- Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers. Urea and Phenol formaldehydes. Engineering Ceramics – Properties and applications of Al2O3, SiC, SiC, Si3, N4, PSZ etc. Fibre and particulate reinforced composites and resin plastics. Powder metallurgy, Manufacturing Process, Compacting, Sintering, Vacuum processing. Properties of Powder processed materials, high energy compaction. Metal matrix composites, preparation properties and uses.

6: Mechanical Properties and Testing- Mechanism of plastic deformation, slip and twinning. Types of fracture – Testing of materials under tension, compression and shear loads – dness tests (Brinell, Vickers and Rockwell) Impact test, Izod and charpy, fatigue and creep test.

7: Introduction to Science and Technology of Nano materials- Nano structured materials, Low- dimensional structures: Quantum wells, Quantum wires, and Quantum dots, Nano clusters & Nano crystals. Electronic and optical properties of nano crystallites, Metallic and semiconducting super lattices. Synthesis of nanostructured materials, Fabrication and characterization of nano electronic devices and MEMS. Basics of synthesis and characterization of nano-multi-component systems for sensors(magnetic, electronic and optical) and electrodes. Synthesis and fabrication of carbon nano structures for fuel cell and energy storage applications.

Text/ Reference Books:

1. Kenneth G. Budinski and Michael K.Budinski, *Engineering Materials* Prentice-Hall of India
2. William D Callister, Material *Science and Engineering*, John Wiley and Sons.
3. Raghavan.V. *Materials Science and Engineering*, Prentice Hall of India.
4. Lakhtin, Y., & Weinstein, N. *Engineering Physical Metallurgy*: University Press of the Pacific.
5. Avner, S. H. *Introduction to physical metallurgy*: McGraw-Hill.
6. Jacobs, J. A., & Kilduff, T. F. *Engineering materials technology: structures, processing, properties, and selection:* Pearson/Prentice Hall.
7. Bolton, W., Engineering *materials technology*: Butterworth-Heinemann.
8. Flinn, R. A., & Trojan, P. K., Engineering *Materials and Their Applications*: Wiley
9. Koch, C. C. *Nanostructured materials: processing, properties, and applications*: William Andrew Pub.
10. NPTEL courses, *http://www.nptel.iitm.ac.in/courses.php?disciplineId=112:* related web and video resources under *Mechanical Engineering* & *Metallurgy and Material Science*

B.Tech. (Mechanical Engineering) 3rd Semester
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MEL215: Machine Drawing

L	T	P
2	0	2

Course Objectives and Course Outcomes:
The objective of this course is to make students understand the principles and requirements of production drawings and learning how to assemble and disassemble important parts used in major mechanical engineering applications. After going through this course, the student shall be able to understand the drawings of mechanical components and their assemblies along with their utility for design of components

Introduction: Principles of Drawing, Requirements of production drawing, Sectioning and conventional representation, Dimensioning, symbols of standard tolerances, Machining Symbols, introduction and Familiarization of Code IS: 296

Classification of Machine Drawings (with examples): Assembly Drawing, Part Drawing, Detailed Drawing, Catalogues Drawing.

Conventional Representation of Machine Components: screw threads, spring, gears, bearings, splined shaft,

Assembly and Part Drawings: couplings, clutches, bearings, gear assemblies, I.C. Engine components, valves, machine tools, etc.

Symbols: Symbols for surface roughness, Weldments, process flow, electrical and instrumentation units.

Solid Modeling: Introduction to solid modelers, solid modeling of various machine parts.

Project: A drawing project.

Text/ Reference Books:

- Ajeet Singh, Machine drawing Includes AutoCAD, Tata Mc GrawHill, 2008.
- ND Junnarkar, Machine Drawing, Pearson Education, 2007.
- N. D. Bhatt, Machine Drawing, Charotar Book Stall, Anand, 1996.
- N. Sidheswar, P. Kanniah and V. V. S. Sastry, Machine Drawing, Tata McGraw Hill, 1983.
- National Drawing Code, http://bis.org.in/other/WC_SP_46_03122014.pdf

B.Tech. (Mechanical Engineering) 3rd Semester
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ESL220: ENVIRONMENTAL STUDIES (COMPULSORY)

Credit 3-0-0

1. **The multidisciplinary nature of environmental studies:** Definition, scope & its importance, Need for public awareness.

2. **Natural resources**: Natural resources and associated problems.

   a) **Forest resources**: Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
   b) **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
   c) **Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
   d) **Food resources**: World food problems, change caused by agriculture and overgrazing, effects or modern agriculture, fertilizer-pesticide problem, salinity, case studies.
   e) **Energy resources**: Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.
   f) **Land recourses**: Land as a resource, land degradation, soil erosion and desertification.
   g) Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

3. **Ecosystem:**
   Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.
   Introduction, types, characteristic features, structure and function of the following ecosystems:
   a. Forest ecosystem
   b. Grassland ecosystem
   c. Desert ecosystem
   d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its Conservation:

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution:

Definition, Causes, effects and control measures of:

a) Air Pollution
b) Water Pollution
c) Soil Pollution
d) Marine Pollution
e) Noise Pollution
f) Thermal Pollution
g) Nuclear Hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

6. Social Issues and Environment:

* From unsustainable to sustainable development
* Urban problems related to energy
* Water conservation, rain water harvesting, watershed management
* Resettlement and rehabilitation of people; its problems and concerns. Case studies
* Environmental ethics: Issues and possible solutions.
* Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents and holocause. Case studies.
* Wasteland reclamation
* Consumerism and waste products
* Environmental Protection Act
* Air (prevention and Control of Pollution) Act
* Water (prevention and Control of Pollution) Act
* Wildlife Protection Act
* Forest Conservation Act
* Issues involved in enforcement o£. environmental legislation
* Public awareness

7. **Human population and the environment**
   * Population growth, variation among nations
   * Population explosion-Family welfare programme
   * Environment and human health
   * Human rights
   * Value education
   * HIV / AIDS
   * Women and child welfare
   * Role of information technology in environment :and human health
   * Case studies
   * **Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs
   * **Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance
8. **Field Work:** Visit to a local area to document environmental assets–river / forest / grassland / hill / mountain. Visit to a local polluted site–Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems–pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.
9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.
10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar.

B.Tech. (Mechanical Engineering) 3rd Semester
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ENP291: Written & Oral Technical Communication Skills

L	T	P
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Students should be asked to prepare Technical Presentation on the emerging areas of Information Technology and present the same to the group of Students.

B.Tech. (Mechanical Engineering) 3rd Semester
(Under Credit Based Continuous Evaluation Grading System)

MEP211: Solid Mechanics

L	T	P
0	0	2

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on Cast Iron.
3. To perform any one hardness tests (Rockwell, Brinell & Vicker's test).
4. To perform impact test to determine impact strength.
5. To perform torsion test and to determine various mechanical properties.
6. To perform Fatigue test on circular test piece.
7. To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
8. Determination of Bucking loads of long columns with different end conditions.

B.Tech. (Mechanical Engineering) 3rd Semester
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MEP 212: Primary Manufacturing

L	T	P
0	0	2

Casting:

1. To determine clay content, moisture content, hardness of a moulding sand sample.
2. To determine shatter index of a moulding sand sample.
3. To test tensile, compressive, transverse strength of moulding sand in green condition.
4. To determine permeability and grain fineness number of a moulding sand sample.

Welding:

1. To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
2. To study MIG, TIG and Spot welding equipment and make weld joints by these processes.

Machining and Forming:

1. To study constructional features of following machines through drawings/ sketches:
   a. Grinding machines (Surface, Cylindrical)
   b. Hydraulic Press
   c. Draw Bench
   d. Drawing and Extrusion Dies
   e. Rolling Mills
2. To grind single point and multipoint cutting tools
3. To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
4. To prepare job on shaper involving plane surface,
5. Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
6. To determine cutting forces with dynamometer for turning, drilling and milling operations.

B.Tech. (Mechanical Engineering) 3rd Semester
(Under Credit Based Continuous Evaluation Grading System)

MEP 214 ENGINEERING MATERIALS

L	T	P
0	0	2

1. Preparation of models/charts related to atomic/crystal structure of metals.
2. Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.
3. Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
4. Practice of specimen preparation (cutting, mounting, polishing ,etching) of mild steel, aluminium and hardened steel specimens.
5. Study of the microstructure of prepared specimens of mild steel, Aluminium and hardened steel.
6. Identification of ferrite and pearlite constituents in given specimen of mild steel.
7. Determination of hardenabilty of steel by Jominy End Quench Test.

B.Tech. (Mechanical Engineering) 3rd Semester
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MEP 215: Basic Simulation Laboratory

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(Simulation Lab. Experiments may be carried out using MATLAB)

1: Creating a One-Dimensional Array (Row / Column Vector) Exercise – Creating a vector of even whole numbers between 31 and 75; Creating a Two-Dimensional Array (Matrix of given size) and (A). Performing Arithmetic Operations - Addition, Subtraction, Multiplication and Exponentiation. (B). Obtaining Modified Matrix - Inverse, Transpose, with Appended and Deleted Elements.

2: Performing Matrix Manipulations - Concatenating, Indexing, Sorting, Shifting, Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis; Creating Arrays X & Y of given size (1 x N) and Performing (A). Relational Operations - >, <, ==, <=, >=, ~= (B). Logical Operations - ~, &, |, XOR

3: Generating a set of Commands on a given Vector (Example: X = [1 8 3 9 0 1]) to (A). Add up the values of the elements (Check with **sum**)
(B). Compute the Running Sum (Check with **sum**), where Running Sum for element j = the sum of the elements from 1 to j, inclusive.
(C). Compute the Sine of the given X-values (should be a vector).
Also, Generating a Random Sequence using **rand() / randn()** functions and plotting them.

4: Evaluating a given expression and rounding it to the nearest integer value using Round, Floor, Ceil and Fix functions; Also, generating and Plots of (A) Trigonometric Functions - *sin(t), cos(t), tan(t), sec(t), cosec(t) and cot(t)* for a given duration *„t'*. (B). Logarithmic and other Functions – log(A), $\log_{10}$(A), Square root of A, Real n^{th} root of A.

5: Creating a vector X with elements, $X_n = (-1)^{(n+1)}/(2n-1)$ and adding up 100 elements of the vector X; and plotting the function, x, x^3, e^x, and $\exp^{(x.x)}$ the interval $0 < x < 4$ (by choosing appropriate mesh values for x to obtain smooth curves), on (A). A Rectangular Plot (B).
A Semi log Plot (C). A log-log Plot.

6: Generating a Sinusoidal Signal of a given frequency (say, 100Hz) and Plotting with Graphical Enhancements - Titling, Labelling, Adding Text, Adding Legends, Adding New Plots to Existing Plot, Printing Text in Greek Letters, Plotting as Multiple and Sub-Plots; *Also,* Making Non-Choppy and Smooth Plot of the functions, $f(x) = \sin(1/x)$ for $0.01 < x < 0.1$ and $g(x) = (\sin x)/x$.

7: Creating A Structure, An Array of Structures and Writing Commands to Access Elements of the created Structure and Array of Structures; *Also,* Solving First Order Ordinary Differential Equation using Built-in Functions; *And,* Creating an M x N Array of Random Numbers using **rand** and setting any value that is < 0.2 to „0' and any value that is ≥ 0.2 to „1' by moving through the Array, Element by Element;

8: Generating normal and integer random numbers (1-D & 2-D) and plotting them;*Also,* Writing a Script (which keeps running until no number is provided to convert) that asks for Temperature in degrees Fahrenheit and Computes the Equivalent Temperature in degrees Celsius. [Hint: Function **is empty** is useful]

9: Writing brief Scripts starting each Script with a request for input (using **input**) to Evaluate the function h(T) using if-else statement,
where h(T)=(T – 10) for 0 < T < 100
=(0.45T+900) for T>100
Exercise: Testing the Scripts written using
A). T = 5, h = -5 and B). T = 110, h = 949.5 Also, Creating a Graphical User Interface (GUI); And, Curve Fitting using
(A) Straight line Fit
(B). Least Squares Fit

10: Interpolation based on following Schemes (A). Linear (B). Cubic (C). Spline *Also,* Generating the first Ten Fibonacci numbers according to the relation $F_n = F_{n-1} + F_{n-2}$ with $F_0 = F_1 = 1$, and Computing the ratio F_n / F_{n-1} for the first 50 Fibonacci numbers.
[Exercise: Verifying that the computed ratio approaches the value of the golden mean (1 + sqrt(5)) / 2]; *Also* Generating Equivalent Square Wave from a Sine Wave of given Amplitude and Frequency; And,. Obtaining the Covariance & Correlation Coefficient Matrices for a given Data Matrix.

Text Books:

1. *Getting Started with MATLAB - A Quick introduction for Scientists & Engineers* by Rudra Pratap, Oxford Univ. Press, 5th edition, 2010.
2. *MATLAB An Introduction with Applications* by Amos Gilat, Wiley Student Edition, 2009.
3. *MATLAB Programming for Engineers* by Stephen J. Chapman, Thomson Learning, 2008.

Reference Books:

1. www.mathworks.com/nn8/moler, e-book, 2009.
2. *Introduction to MATLAB 7 for Engineers* by William Palm III, McGraw-Hill, 2nd edition,
2004.
3. *MATLAB and its Applications in Engineering* by Raj Kumar Bansal, Ashok Kumar Goel, Manoj Sharma - Pearson Education,1st edition, 2009.

B.Tech. (Mechanical Engineering) 4th Semester
(Under Credit Based Continuous Evaluation Grading System)

MEL221: Mechanisms and Machines

L	T	P
3	1	0

Course Objectives and Course Outcomes:
Planar kinematics of rigid bodies, systems of rigid bodies and particles, problem formulation and solution methods for the dynamic equations of motions for planar motion of rigid bodies, develop simplified, rigid body models for systems of mechanical components, introduce the concepts and uses of work and kinetic energy, understand fundamental concepts and solution strategies for cams, mechanical vibration problems, gears, concept of balancing. The students will understand the basic concepts of machines and able to understand constructional and working features of important machine elements. The students should be able to understand various parts involved in kinematics of machines for different applications. The students shall also be able to understand requirements of basic machine parts which would help them to understand the design aspects of the machine parts.

1. Introduction-General concepts, Introduction of Simple mechanism, Different types of Kinematics pair, Grublers rule for degree of freedom, Grashof's Criterion for mobility determination. Inversions of 3R-P, 2R-2P chains.

2. Kinematic Analysis – Concepts of vectorial analysis. Velocity and Acceleration, Analysis of planar mechanisms.

3. Cams- Classification, Cams with uniform acceleration and retardation, SHM, Cylcloidal motion, oscillating followers.

4. Vibrations- Vibration analysis of SDOF systems, Natural, damped forced vibrations, Based- excited vibrations, transmissibility ratio.

5. Gears- Geometry of tooth profiles, Law of gearing, Involute profile, interference, helical, spiral and worm gears, simple, compound gear trains. Epicyclic gear trains – Analysis by tabular and relative velocity method, fixing torque.

6. Dynamic Analysis- Slider-crank mechanisms, turning moment computations.

7. Balancing- Static and Dynamic balancing, Balancing of revolving & reciprocating masses in single and multi-cylinder engines.

8. Gyroscopes-Basic concepts Gyroscopic law, effect of gyroscopic couple on automobiles, ships, aircrafts.

Text/ Reference Books:

1. Mallik, A. K., Ghosh, A., & Dittrich, G. *Kinematic analysis and synthesis of mechanisms*: CRC Press.
2. Uicker, J. J., Pennock, G. R., & Shigley, J. E. *Theory of machines and mechanisms*: OUP.
3. Norton, R. L. *Design of machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines*: McGraw-Hill.
4. Rattan.S.S. *Theory of Machines*: McGraw-Hill Education (India) Pvt Ltd.
5. Rao, J. S. The Theory Of Machines Through Solved Problems: New Age International.
6. Ballaney PL, *Theory of Machines and Mechanisms*, Khanna Publications.
7. Bevan, T. *The theory of machines: A Text-Book for Engineering Students*: Pearson Education
8. Vinogradov, O. G. *Fundamentals of kinematics and dynamics of machines and mechanisms:* CRC Press.
9. NPTEL courses: *http://nptel.iitm.ac.in/courses.php*, related web and video resources on Kinematics of Machines and Dynamics of Machines.

B.Tech. (Mechanical Engineering) 4th Semester
(Under Credit Based Continuous Evaluation Grading System)

MEL222 CAD and Computer Graphics

L T P
3 0 0

Course objectives and Course outcomes:

Overview of CAD, CAD Applications, Solid Modeling: Wireframe, B-Rep, CSG approaches, Transformations and Projections, Mathematical representation of curves and surfaces, Ferguson, Bezier and B-spline curves and properties, Ferguson, Bezier and Bspline surfaces and properties, Computations for Geometric Design, Introduction to Finite Element Analysis and Optimization.

1. Introduction- Need and Scope of Computer Aided Design, Fundamental of CAD and computer graphics- Application areas, Hardware and software- overview of graphics systems, video-display devices, and raster-scan systems, random scan systems, graphics monitors and workstations and input devices. Interactive hardware/software techniques, Drawing standards, dimensioning and text writing, concept of layers, advanced concepts of CAD software- blocks, UCS, 3D-line, 3D object, DXF & DXB file formats. Output primitives- Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives Scan line polygon fill algorithm, boundary fill and flood-fill algorithms.

2. 2-D geometrical transforms- Translation, scaling, rotation, reflection and shear transformations. Matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 2-D viewing- The viewing pipeline, viewing coordinate reference frame. Window to view port coordinate transformation, viewing functions. Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

3. 3-D Object Representation- Polygon surfaces, quadric surfaces, spline representation. Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon-rendering methods. 3-D viewing- Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

4. 3-D Geometric transformations-Translation, rotation, scaling, reflection and shear transformations, composite transformations. Visible surface detection methods-Classification, back-face detection, depth buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods.

5. Finite Element Method- Numerical Methods-Introduction, Errors in numbers, Root finding-Bisection method, Newton Raphson method, Curve fitting-Least square method, Numerical differentiation-Newton's interpolation, Numerical Integration-Trapezoidal and Simpson method. Introduction to the principles of Finite elements modeling, Stiffness matrix/displacement matrix, Stiffness matrix for spring system, bar & beam elements, bar elements in 2D space (truss element), solution of finite element equation-higher order and iso-parametric elements, equilibrium problems in structural mechanics, Eigen value problems.

6. Introduction to CAD CAM- Overview, orientation and application commands of CAD and CAE modeling software platforms for feature based Parametric and Variation modelling and analysis. Boolean, and sweep operations on primitives with applications to CAD of machine elements.

Text/ Reference Books:

1. McConnell, J. J. *Computer graphics theory into practice* Jones and Bartlett Publishers.
2. Davis, M. J. *Computer Graphics* Nova Science Pub Inc.
3. Rogers, D. F., Earnshaw, R. A., Graphics, B. C. S. C., Group, D., & Society, C. G. *Computer graphics techniques theory and practice* Springer-Verlag.
4. Salomon, D. *Transformations and projections in computer graphics* Springer.
5. Bethune, J. D. *Engineering Design and Graphics with Solid Works* Prentice Hall.
6. Zeid, I. *Mastering CAD/CAM (Engineering Series)* McGraw-Hill Higher Education.
7. NPTEL courses *http//nptel.iitm.ac.in/courses.php*- web and video resources on *Computer Aided Design and Manufacturing.*

B.Tech. (Mechanical Engineering) 4th Semester
(Under Credit Based Continuous Evaluation Grading System)

MEL223 Engineering Workshop-II

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1	0	0

(Practical Hands-on Training with one hour lecture covering salient features of following s):

1. Turning- Taper turning using tailstock offset method and taper turning attachment Eccentric external turning using a four jaw chuck.

2. Boring- Using a boring tool – both concentric and eccentric. Boring using a boring bar in a centre lathe. Square and hexagonal hole drilling using die-sinking EDM.

3. Grinding - Cylindrical grinding using grinding attachment in a centre lathe

4. Thread Cutting- Internal and external thread cutting using a single point cutting tool.

5. Gears- Cutting teeth of spur gears using form milling cutter in a universal milling machine, Gear hobbing, Gear shaping.

6. Welding- Introduction. Edge/Joint preparation in welding and joining using shielded metal arc welding. Hands-on practice on metal inert gas welding (MIG) or gas metal arc welding. Hands-on practice on tungsten inert gas welding (TIG) or gas tungsten arc welding. Hands-on practice on spot welding. Hands-on practice on submerged arc welding

Text/Reference Books:

1. Kalpakjian, S., & Schmid, S. R. *Manufacturing processes for engineering materials*: Pearson Education.
2. DeGarmo, E. P., Black, J. T., & Kohser, R. A. *Materials and processes in manufacturing*: Wiley.
3. Lindberg, R. A. *Processes and materials of manufacture*: Allyn and Bacon.
4. Chapman, W. *Workshop Technology*: Edward Arnold.
5. NPTEL courses, *http://www.nptel.iitm.ac.in/courses.php?disciplineId=112* web and video resources on Manufacturing Processes II by Prof. A.K. Chattopadhyay, Prof. A.B. Chattopadhyay, Prof. S. Paul.

B.Tech. (Mechanical Engineering) 4th Semester
(Under Credit Based Continuous Evaluation Grading System)

MEL224 Design of Machine Elements

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Course objectives and Course outcomes:
Basics of mechanical design: visual thinking, engineering drawing, and machine anatomy. Basics of manufacturing: processes, and materials aspects. Use of computers in various phases of design and manufacturing.

Course Contents:

1. Introduction to Mechanical Engineering Design- Review of models of Solid mechanics, uncertainties in design equations and factor of safety. Role of off the shelf available machine elements and standards. Standard numbering system including BIS designations of materials. Application of theories of failure to design

2. Design procedure and applications of Statically Loaded Machine Elements- Design of elements subjected to simple loading: Riveted joints, Screws including power screws Bolted joints including eccentrically loaded joints, Axles, and coupling, Clutches and brakes.

3. Fatigue- Introduction to design for fatigue strength. Endurance and modifying factors. Surface strength. Review of design procedure of fatigue failure with application to the design of bolts and springs subjected to fatigue loading.

4. Design procedure and applications of Dynamically Loaded Machine Elements. Shafts, Spur, helical, bevel and worm gears, Journal and rolling contact bearings, Belts and chains. Assemblies of various machine elements like those of a screw jack and a gear box.

Text/Reference Books:

1. Budynas, R. G., & Nisbett, J. K.. *Shigley's mechanical engineering design*: McGraw-Hill.
2. Norton, R. L. *Machine design: an integrated approach*: Prentice Hall
3. Spotts, M. F., Shoup, T. E., & Hornberger, L. E. *Design of machine elements*: Pearson /Prentice Hall
4. Hamrock,B.J. et.al., Fundamentals of Machine Elements, McGraw Hill
5. Bhandari, V. B. *Design of Machine Elements*: McGraw-Hill Education (India) Pvt Ltd.
6. Juvinall, R. C., & Marshek, K. M. *Fundamentals of machine component design*: John Wiley.
7. NPTEL courses: *http://nptel.iitm.ac.in/courses.php* - web and video resources on *Dynamics of Mechanical System/ Design of Machine Elements /Machine Design.*

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MEL225 Fluid Mechanics

L	T	P
3	1	0

Course Objectives and Course Outcomes:
To provide the basic knowledge of fluid statics and dynamics.

1. Basic Concepts and Properties- Fluid – definition, distinction between solid and fluid - s and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension. Fluid statics concept of fluid static pressure, absolute and gauge pressures – pressure measurements by manometers and pressure gauges. Hydrostatic forces on submerged surfaces, Stability of floating bodies.

2. Fluid Kinematics and Fluid Dynamics- Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net. Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation, applications - Venturi meter, Orifice meter, Pitot tube. Dimensional analysis - Buckingham's Pei theorem- applications - similarity laws and models.

3. Incompressible Fluid Flow- Viscous flow - Navier - Stoke's equation (Statement only) - Shear stress, pressure gradient relationship - laminar flow between parallel plates - Laminar flow through circular tubes. (Hagen Poiseulle's equation). Hydraulic and energy gradient - flow through pipes - Darcy -Weisback's equation – pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - power transmission. Boundary layer flows, boundary layer thickness and boundary layer separation. Drag and lift coefficients.

4. Hydraulic Turbines- Fluid machines definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagram's - head and specific work - components of energy transfer - degree of reaction. Hydro turbines definition and classifications - Pelton turbine - Francis turbine - propeller turbine Kaplan turbine .Working principles - velocity triangles - work done - specific speed – efficiencies - performance curve for turbines.

5. Hydraulic Pumps- Pumps definition and classifications. Centrifugal pump classifications, working principles, velocity triangles, specific speed, efficiency and performance curves. Reciprocating pump classification, working principles, indicator diagram, work saved by air vessels and performance curves ,cavitation in pumps Rotary pumps working principles of gear and vane pumps.

Text /Reference Books:

1. Som, S. K., & Biswas, G. *Introduction to fluid mechanics and fluid machines*: Tata McGraw- Hill.
2. Fox, R. W., McDonald, A. T., & Pritchard, P. J. *Introduction to fluid mechanics*: Wiley.
3. Munson, B. R., Young, D. F., & Okiishi, T. H. *Fundamentals of fluid mechanics: Student solutions manual*: Wiley.
4. Bansal, R. K. *A textbook of fluid mechanics and hydraulic machines: (in S.I. units)*: Laxmi Publications.
5. Massey, B. S., & Ward-Smith, J. *Mechanics of fluids*: Stanley Thornes.
6. NPTEL courses: http://nptel.iitm.ac.in/courses.php - web and video resources on *Fluid Mechanics.*

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MEL226 Mechanical Measurement and Metrology

L	T	P
3	0	0

Course Objectives:
To impart basic knowledge about the measurement systems and their components and various methods of engineering metrology.

Course Contents: Mechanical Measurement

1. Introduction to measurements, Errors in measurements, Statistical analysis of data, Regression analysis, correlation, estimation of uncertainty and presentation of data, design of experiments.
2. Measurement of field quantities like temperature, pressure, velocity by intrusive and non-intrusive techniques under various conditions met with in practice like steady and transient conditions.
3. Measurement of derived quantities like heat flux, volume/mass flow rate, temperature in flowing fluids.
4. Measurement of thermo-physical properties, radiation properties of surfaces, vibration and noise.
5. Computer assisted data acquisition, data manipulation, data presentation.

Metrology:

1. Measurement of length, measurement of angle
2. Limits and fits
3. Measurement of geometric forms, straightness, flatness, roundness etc. Mechanical and optical methods.
4. Measurement of screw threads and gears.
5. Measurement of surface roughness and texture
6. Introduction to CMM. In-process gages.
7. Inspection and quality monitoring.

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MEP221: Mechanisms and Machines

L	T	P
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1. To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.
2. To study the various inversions of kinematic chains.
3. Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
4. Determination of gyroscopic couple (graphical method).
5. Balancing of rotating masses (graphical method).
6. Cam profile analysis (graphical method)
7. Determination of gear- train value of compound gear trains and epicyclic gear trains.
8. To draw circumferential and axial pressure profile in a full journal bearing.
9. To determine coefficient of friction for a belt-pulley material combination.
10. Determination of moment of inertia of flywheel.

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MEP222 CAD & Computer Graphics

L	T	P
0	0	2

COMPUTER AIDED DRAFTING OF MACHINE ELEMENTS:
Orthographic views - Isometric views - Sectional views. Dimensioning - Annotations - Symbols – Welding - Surface finish - Threads. Text - Bill of Materials- Title block. Exercise: Knuckle, Gib and Cotter Joint - Screw Jack - Foot step bearing.

GEOMETRIC MODELING OF MACHINE COMPONENTS:
Protrusion - cut - Sweep - Revolve - Draft and loft - Modify/edit - Pattern - Transformation - Boolean operation. Exercise: Individual parts of Universal Joint - Flange Coupling - Piston and Connecting rod.

CONVERSION OF 3D TO 2D:
Conversion of 3D to 2D and Mass property calculations for parts created in Units I and II.

ASSEMBLY OF MACHINE PARTS:
Exercise: Assemble from parts created in Unit II.

FINITE ELEMENT ANALYSIS:
FEA of simple structural members - Cantilever beam - Simply supported beam and a plate with a hole.

LIST OF EXPERIMENTS:

1. Orthographic projections – I (from part model)
2. Orthographic projections – II (from assembly model)
3. 3D part modeling with basic features.
4. 3D part modelling with advanced features.
5. 3D assembly modelling.
6. Data exchange standards.
7. 3D to 2D conversion.
8. Structural analysis

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MEP223 Engineering Workshop-II

L	T	P
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1. Introduction- lathe machine, plain turning, Step turning & grooving (Including lathe mechanisms, simple problems).
2. Taper turning-compound rest/offset method & Drilling using lathe (Including Drilling feed mechanism, Twist drill nomenclature, and Different types of taper turning operations).
3. External threading-Single start (Including Thread cutting mechanism-simple problems).
4. Eccentric turning-Single axis.
5. Shaping-V-Block (Including Shaper quick return mechanism).
6. Grinding-Cylindrical /Surface/Tool & cutter.
7. Slotting-Keyways (Including Broaching tool nomenclature and Slotter mechanism).
8. Milling-Polygon /Spur gear (Including Milling mechanism, simple problems).
9. Gear hobbing-Helical gear.
10. Drilling, reaming, counter boring.
11. Planning/Capstan lathe/Burnishing process (Planner Mechanism, Description of capstan and turret lathe).
12. Mini Project work- Application oriented products using above experiments.

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MEP224 Design of Machine Elements

L	T	P
0	0	4

1. Design of circumferential/longitudinal riveted joint of boiler.
2. Design of rigid flange coupling.
3. Design of flexible coupling (Bush pin type)
4. Design of eccentrically loaded bracket.
5. Design of pipe and pipe joints subjected to internal pressure.
6. Design of shaft carrying one pulley and supported in two bearing.

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MEP225 Fluid Mechanics

L	T	P
0	0	2

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter)
4. To determine the discharge coefficient for a V- notch or rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficients for pipes of different diameters.
8. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
9. To determine the velocity distribution for pipeline flow with a pitot static probe.
10. Experimental evaluation of free and forced vortex flow.

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MEP226 Mechanical Measurement and Metrology

L	T	P
0	0	2

1. Measurement of an angle with the help of sine bar
2. Measurement of surface roughness of a machined Plate, Rod and Pipe
3. Measurement of gear elements using profile projector
4. Measurement of effective diameter of external threads using Three wire method
5. Measurement of thread element by Tool maker's microscope
6. Calibration of a pressure gauge with the help of a dead weight gauge tester
7. Use of stroboscope for measurement of speed of shaft
8. Use of pitot tube to plot velocity profile of a fluid through a circular duct
9. Preparation of a thermocouple, its calibration and application for temperature measurement