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|------------------|--|
| Programme Name/s | : Automobile Engineering./ Mechanical Engineering/ Mechatronics/ Production Engineering/ |
| Programme Code | : AE/ ME/ MK/ PG |
| Semester | : Second |
| Course Title | : ENGINEERING DRAWING |
| Course Code | : 312311 |

I. RATIONALE

Engineering drawing lays the foundation for visualizing the situation and delivering the essential instructions, required to carry out engineering jobs. This course aims at developing the ability to read and draw projection of lines, planes, solids. It also aims at reading and drawing the sections of the orthographic views. Engineering drawing also intends to develop the ability to visualize and draw curves of intersection and develop lateral surfaces of various solids

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use different drawing instruments for solving broad based engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Apply principles of sectional orthographic projections for drawing given pictorial views.
- CO2 - Draw projection of lines and planes.
- CO3 - Draw projections of given solids for various orientations.
- CO4 - Interpret curves of intersection for given solids.
- CO5 - Draw development of lateral surfaces of various solids.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | | Credits | Paper Duration | Assessment Scheme | | | | | | | | | |
|---|---------------------|------|-------------------|--------------------------|----|----|-----|-----|--------|---------|----------------|----------------------------|-------|-------|-------|-------------|-----|-------------|-----|-----|-----|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | Theory | | | Based on LL & TL Practical | | | | Based on SL | | Total Marks | | | |
| | | | | CL | TL | LL | | | FA-TH | | | SA-TH | Total | FA-PR | SA-PR | SLA | Max | | Min | | |
| | | | | | | | | | | | | | | | | | | | | Max | Min |
| 312311 | ENGINEERING DRAWING | EDG | SEC | 2 | - | 4 | 2 | 8 | 4 | 4 | 30 | 70 | 100 | 40 | 25 | 10 | 25@ | 10 | 25 | 10 | 175 |
| <p>Total IKS Hrs for Sem. : 4 Hrs Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA - Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination Note :</p> <ol style="list-style-type: none"> 1. FA-TH represents average of two class tests of 30 marks each conducted during the semester. 2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester. 3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work. 4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks 5. 1 credit is equivalent to 30 Notional hrs. 6. * Self learning hours shall not be reflected in the Time Table. 7. * Self learning includes micro project / assignment / other activities. | | | | | | | | | | | | | | | | | | | | | |

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|---|---|---|
| 1 | TLO 1.1 Draw different types of sectional views. TLO 1.2 Draw sectioning and hatching conventions. TLO 1.3 Develop sectional orthographic views from the pictorial views of given object. TLO 1.4 Interpret the given drawing. | Unit - I Sectional Orthographic Views 1.1 Cutting plane line. 1.2 Types of sectional views: Full Section, half section, Partial or Broken section, Revolved section, removes section, offset section, aligned section. 1.3 Sectioning conventions. 1.4 Hatching or section lines. 1.5 Conversion of pictorial views into sectional orthographic views (complete object involving slots, threads, ribs, etc). | Model Demonstration Video Demonstrations |
| 2 | TLO 2.1 Draw different position of lines with respect to projection planes. TLO 2.2 Draw projection of lines in various positions according to the given condition. TLO 2.3 Draw various types of planes based on their orientation. TLO 2.4 Draw projection of planes in various orientations according to the given condition. | Unit - II Projection of Lines and Planes 2.1 Projection of straight lines involving following positions- i. Parallel to both the planes. ii. Perpendicular to one plane. iii. Inclined to one plane and parallel to the other plane. iv. Inclined to both the planes. 2.2 Traces of line. 2.3 Projection of planes involving following orientations- i. Plane parallel to one principal plane and perpendicular to the other plane. ii. Plane inclined to one principal plane and perpendicular to the other plane. | Model Demonstration Video Demonstrations |
| 3 | TLO 3.1 Draw projection of given regular solids. TLO 3.2 Draw projection of regular solids according to their orientation with planes. TLO 3.3 Interpret orientation of axis with respect to projection of planes of solids. | Unit - III Projection of Solids 3.1 Types of solids. 3.2 Projection of following solids- i. Regular polyhedron – Tetrahedron, Hexahedron (Cube) ii. Regular Prisms and Pyramids- Triangular, Square. iii. Regular solids of revolution- Cylinder, Cone. 3.3 Projection of given solids With Axis a. Perpendicular to one of the principal projection plane. b. Inclined to one of the principal plane and parallel to the other. c. Parallel to both principal planes. | Model Demonstration Video Demonstrations |
| 4 | TLO 4.1 Interpret intersection for the given solids. TLO 4.2 Draw curves of intersection of the given solid combination. | Unit - IV Intersection of Solids 4.1 Curves of intersection of surfaces - Prism with Prism (Triangular, Square), Cylinder with cylinder. 4.2 Curves of intersection of surfaces - Square Prism with Cylinder when – i. Axes are at 90° and bisecting. ii. Axes are at 90° and offset. 4.3 Curves of intersection of surfaces - Cylinder with Cone: when the axis of cylinder is parallel to both the reference planes and cone resting on base on HP with axis intersecting and offset from axis of cylinder. | Model Demonstration Video Demonstrations Hands-on of the intersecting solids |
| 5 | TLO 5.1 Draw development of lateral surfaces of the given solid. TLO 5.2 Identify parts where concept of development of the given surfaces is required. TLO 5.3 Draw development of given sheet metal. | Unit - V Development of Surfaces 5.1 Developments of lateral surfaces of cube, prisms (Triangular, Square), cylinder, pyramids (Triangular, Square), cone. 5.2 Applications of development of surfaces such as tray, funnel. | Model Demonstration Video Demonstrations Hands-on to develop lateral surface from the existing solids |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|-------|--|----------------|---------------------------------|
| LLO 1.1 Apply method of projection for drawing simple sectional orthographic views. | 1 | *Draw two problems on sectional orthographic projections (simple object) using first angle method of projection. | 4 | CO1 |
| LLO 2.1 Apply method of projection for drawing simple sectional orthographic views. | 2 | *Draw two problems on sectional orthographic projections (object consisting of slot/rib/thread) using first angle method of projection. | 4 | CO1 |
| LLO 3.1 Draw the projection of lines for the given positions of lines. | 3 | *Draw two problems on projection of lines showing the traces of line. | 4 | CO2 |
| LLO 4.1 Draw the projection of planes for the given orientation of plane. | 4 | Draw two problems on projection of planes when plane is parallel to one principal plane and perpendicular to the other plane. | 4 | CO2 |
| LLO 5.1 Draw the projection of planes for the given orientation of plane. | 5 | *Draw two problems on projection of planes when plane is inclined to one principal plane and perpendicular to the other plane. | 4 | CO2 |
| LLO 6.1 Draw the projection of solids for the given position of plane. | 6 | *Draw any two problems on projection of solids with axis perpendicular to one of the principal projection planes. | 4 | CO3 |
| LLO 7.1 Draw the projection of solids for the given position of plane. | 7 | *Draw any two problems on projection of solids with axis inclined to one of the principal plane and parallel to the other. | 4 | CO3 |
| LLO 8.1 Draw the projection of solids for the given position of plane. | 8 | *Draw any two problems on projection of solids with axis parallel to both principal planes. | 4 | CO3 |
| LLO 9.1 Draw the intersection of solids as per given situation. | 9 | Draw problems on intersection of solids when intersecting solids are -Prism with Prism, Cylinder with cylinder. | 4 | CO4 |
| LLO 10.1 Draw the intersection of solids as per given situation. | 10 | *Draw problems on intersection of solids when intersecting solid is - Square Prism with Cylinder when . 1. Axes are at 90° and bisecting. 2. Axes are at 90° and offset. | 4 | CO4 |
| LLO 11.1 Draw the intersection of solids as per given situation. | 11 | *Draw problems on intersection of solids when intersecting solids are Cylinder with Cone and the axis of cylinder is parallel to both the reference planes and cone resting on base on HP with axis intersecting and offset from axis of cylinder. | 4 | CO4 |
| LLO 12.1 Draw the developments of lateral surfaces of given object. | 12 | Draw problems on developments of lateral surfaces of cube, prisms. | 4 | CO5 |
| LLO 13.1 Draw the developments of lateral surfaces of given object. | 13 | *Draw problems on developments of lateral surfaces of cylinder, pyramids. | 4 | CO5 |
| LLO 14.1 Draw the developments of lateral surfaces of given object. | 14 | *Draw problems on developments of lateral surfaces of tray, funnel. | 4 | CO5 |
| LLO 15.1 Collect information of an ancient Indian culture related to engineering drawing. | 15 | *Prepare a report on the use of various solid geometrical shapes employed in ancient Indian constructions (IKS). | 4 | CO1 CO2 CO3 CO4 CO5 |
| Note : Out of above suggestive LLOs - | | | | |
| <ul style="list-style-type: none"> ** Marked Practicals (LLOs) Are mandatory. Minimum 80% of above list of lab experiment are to be performed. Judicial mix of LLOs are to be performed to achieve desired outcomes. | | | | |

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Sectional Orthographic projections. Minimum 5 problems
- Projection of Lines. Minimum 5 problems
- Projection of planes. Minimum 5 problems
- Projection of solids. One problem for each type of solids.
- Intersection of solids surfaces. One problem for each type of solids.
- Development of lateral surfaces of solids. One problem for each type of solids.

Micro project

- Student should collect fabricated job/component nearby workshop/industries/ and try to show curves of intersections for different solid surfaces.
- Each student will assess at least one sheet of other students (May be a group of 4 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.
- Students should collect component, job/sample from nearby workshops/industries and try to show the development of lateral surfaces of that.
- Each student should explain at least one problem for construction and method of drawing in sheet. Teacher will assign the problem of particular sheet to be explained to each student.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|--|---------------------|
| 1 | Models of objects for sectional orthographic. | 1,2 |
| 2 | Models/charts/ animated video of development of lateral surfaces of various solids. | 12,13,14 |
| 3 | Models/ Charts/ animated video of objects mentioned in unit no.2. | 3,4,5 |
| 4 | Models/charts/ animated video of projections of different solids. | 6,7,8 |
| 5 | Models/charts/ animated video of intersections of various solids. | 9,10,11 |
| 6 | Drawing Table with Drawing Board of Full Imperial/ A1 size. | All |
| 7 | Set of various industrial drawings being used by industries. | All |
| 8 | Drawing equipment and instruments for class room teaching-large size: T-square or drafter (Drafting Machine). Set squares (45°and 30°-60°) Protractor. Drawing instrument box (containing set of compasses and dividers). Drawing sheets, Drawing pencils, Eraser, Drawing pins / clips. | All |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|-------|------|------------|-------------|----------------|---------|---------|---------|-------------|
|-------|------|------------|-------------|----------------|---------|---------|---------|-------------|

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|--------------------------------|-------------|----------------|----------|----------|-----------|-------------|
| 1 | I | Sectional Orthographic Views | CO1 | 4 | 0 | 0 | 14 | 14 |
| 2 | II | Projection of Lines and Planes | CO2 | 6 | 0 | 0 | 12 | 12 |
| 3 | III | Projection of Solids | CO3 | 6 | 0 | 0 | 14 | 14 |
| 4 | IV | Intersection of Solids | CO4 | 7 | 0 | 0 | 14 | 14 |
| 5 | V | Development of Surfaces | CO5 | 7 | 0 | 0 | 16 | 16 |
| Grand Total | | | | 30 | 0 | 0 | 70 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering -60% weightage to process -40% weightage to product
- Tests

Summative Assessment (Assessment of Learning)

- End term exam- Theory
- End term exam- Practical (Lab Performance)

XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|-----------------------|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|--------|--------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO- 1 | PSO- 2 | PSO- 3 |
| CO1 | 3 | 3 | - | 2 | - | 2 | 2 | | | |
| CO2 | 3 | 3 | - | 2 | - | 2 | 2 | | | |
| CO3 | 3 | 3 | - | 2 | - | 2 | 2 | | | |
| CO4 | 3 | 3 | 2 | 2 | - | 2 | 2 | | | |
| CO5 | 3 | 3 | 2 | 2 | - | 2 | 2 | | | |

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|-------------------------------|---|---|
| 1 | Bureau of Indian Standards. | Engineering Drawing Practice for Schools and Colleges IS: SP-46 | Third Reprint, October 1998 ISBN No. 81-7061-091-2 |
| 2 | Bhatt, N.D. | Engineering Drawing | Charotar Publishing House, 2010 ISBN No. 978-93-80358-17-8 |
| 3 | Bhatt, N.D.; Panchal, V. M | Machine Drawing | Charotar Publishing House, 2010 ISBN No. 978-93-80358-11-6 |
| 4 | Jolhe, D.A. | Engineering Drawing | Tata McGraw Hill Edu. New Delhi, 2010, ISBN No. 978-0-07-064837-1 |
| 5 | Dhawan, R. K. | Engineering Drawing | S. Chand and Company New Delhi, ISBN No. 81-219-1431-0 |
| 6 | Agrawal Basant , Agrawal C.M. | Engineering drawing | McGraw Hill Education ,New Delhi, ISBN No. 978-1259062889 |
| 7 | Narayana, K.L., Kannaiah. P. | Engineering Drawing | Scitech PublicationsIndia, Chennai ISBN No-978-8183714433 |
| 8 | Singhania Nitin | Indian Art And Culture | McGraw Hill, ISBN No-978-9354601804 |

XIII. LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|---------------------------------|
| 1 | https://youtu.be/3VWnhRCF_0M | Sectional Orthographics |
| 2 | https://youtu.be/3WXPanCq9LI | Projection of lines |
| 3 | https://youtu.be/44glqyyw7OM | Projection of Plane |
| 4 | https://youtu.be/RE_ZG_SSsV8 | Projection of solids |
| 5 | https://youtu.be/gIRsXiTKfDo | Projection of solids |
| 6 | https://youtu.be/q4uZYDtO05s | Projection of solids |
| 7 | https://youtu.be/rerGFp3V6W8 | Intersection of solids |
| 8 | https://youtu.be/40pvNA0_sNM | Intersection of solids |
| 9 | https://youtu.be/P5oPrynRsTI | Development of lateral surfaces |
| 10 | https://youtu.be/vqk7SnpDQvg | Development of lateral surfaces |

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students