

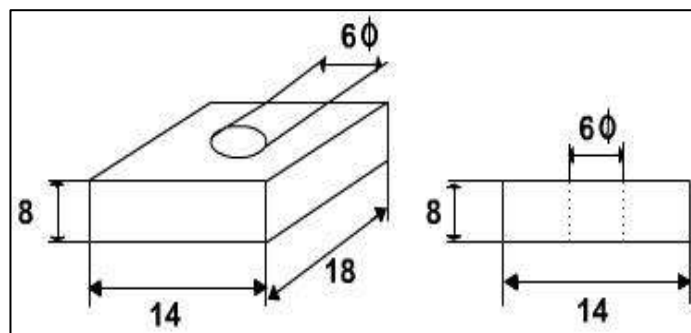
**3RD SEM./AERO./DIP.MECH/MECH(MAIN/PROD/SAND/ IND.INT/AUTO)/
MECH. ENGG 2020(W)NEW
Th-1- Production Technology**

Full Marks: 80

Time- 3 Hrs

Answer any **five** Questions including Q No.1 & 2
Figures in the right-hand margin indicates marks

1. Answer **All** questions 2 x 10
- a. What is blanking operation?
 - b. Why cores are needed in casting?
 - c. Explain Sintering process.
 - d. Why dies are used in press work?
 - e. Name any two materials suitable for Oxy-acetylene Welding Process.
 - f. Jigs & Fixtures increases the production cycle time (True/False). Justify your answer.
 - g. Define Extrusion process.
 - h. Classify the different types of Rolling Process.
 - i. What are the benefits of Production Technology in Engineering?
 - j. What do we understand by economics of casting?
2. Answer **Any Six** Questions 6 x 5
- a. The machining allowance for cast iron for size up to 12 inch is 0.12 inch and from 12 inch to 20 inch is 0.20 inch. Redraw the dimension of the part shown in the figure with dimensions including machining allowance.



- b. Discuss about the oxidizing and reducing zones of a cupola furnace.
- c. Compare Jigs with Fixtures
- d. Explain Resistance welding process.
- e. Discuss about the various types of punches.
- f. Compare hot rolling with cold rolling.
- g List the different advantages of powder metallurgy.

3	Explain 3-2-1 point location of a rectangular jig.	10
4	Write short notes on:	10
a	Compound Dies	
b	Direct Extrusion	
c	Blending	
d	Undercut	
5	Discuss about various types of destructive and non-destructive types of tests carried out to detect welding defects.	10
6	Explain GMAW process with neat sketch.	10
7	Discuss about any five types of casting defects, its causes and remedies.	10

Th-2 Strength of Material

Full Marks:80

TIME:3 Hour

Answer any five question including QNO 1 & 2 are compulsory.

Figures in the right hand margin indicate marks.

N01. Answer all questions. (2X10)

- (a) Define temperature stress
- (b) What is the difference between stress and strain?
- (c) Define point of contra-flexure.
- (d) Define cantilever beam with example.
- (e) What is resilience?
- (f) What do you mean by hoop stress and longitudinal stress?
- (g) What do you mean by column?
- (h) Define torsion
- (i) What do you mean by section modulus?
- (j) Define principal stress and its uses.

N02. Answer any six questions. (5X6)

- (a) A rod 150cm long and of diameter 2.0cm is subjected to an axial pull of 20KN. If the modulus of elasticity of the material of the rod is $2 \times 10^5 \text{ N/mm}^2$. Determine (I) the stress (II) the strain, and (III) the elongation of the rod.
- (b) Show diagrammatically different types of beams and loads.
- (c) What are the assumptions taken while deriving bending equations under theory of simple bending?
- (d) Derive expression for hoop stress and longitudinal stress in case of thin cylindrical shell.
- (e) Find the maximum shear stress induced in a solid circular shaft of diameter 15cm when the shaft transmits 150kw power at 180 r.p.m
- (f) Derive the formula section modulus for rectangular section and circular section.
- (g) Derive relationship between modulus of elasticity and modulus of rigidity.
- (h) A point in a strained material is subjected to two mutually perpendicular tensile stresses of 200Mpa and 100Mpa. Determine the intensities of normal, shear and resultant stresses on a plane inclined at 30° with the axis of minor tensile stress.

NO3. Prove the relation

$$M/I = \sigma/y = E/R$$

Where M= bending moment

I= moment of inertia

σ = bending stress in a fibre, at a distance y from the neutral axis

E= young's modulus and

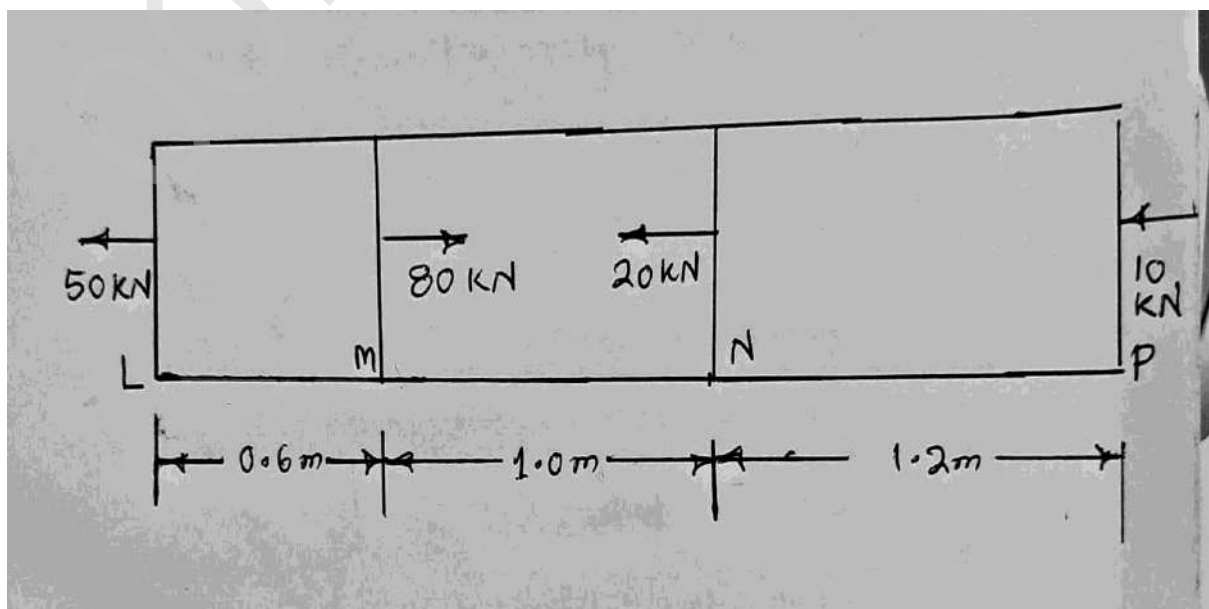
R= radius of curvature (10)

NO4. A simply supported beam of length 6m carries point load of 3KN and 6KN at distances of 2m and 4m from the left end. Draw the shear force and bending moment diagram for the beam. (10)

NO5. A reinforced short concrete column 250mmX250mm in section is reinforced with 8 steel bars. The total area of steel bars is 2500mm². The column carries a load of 390KN. If the modulus of elasticity for steel is 15times that of concrete, find the stresses in concrete and steel. (10)

NO6. Define buckling load. State formula for buckling load in column with various end condition. (10)

NO7. A brass bar having cross-sectional area of 1000mm² is subjected to axial forces shown in the figure. Find the total elongation of the bar. Modulus of elasticity of brass is 100GN/m². (10)



TH3-Engineering Material

Full Marks:80

Time:3Hours

Answer any **Five** Questions including Q No. 1&2
Figures in the right hand margin indicates marks

1. Answer all questions 2×10
- (a) What do you mean by Ductility?
 - (b) Give any two suitable examples of nonferrous material.
 - (c) Write down any two applications of low carbon steel.
 - (d) What is phase diagram?
 - (e) What are the limitations of a iron-carbon phase diagram?
 - (f) What do you mean by Point defect in a crystal?
 - (g) What do you mean by Tempering?
 - (h) Write down the composition of Brass.
 - (i) Give any two suitable examples of ceramic material.
 - (j) Write down any two properties of elastomers. 5×6
2. Answer any six questions
- (a) Briefly classify materials into ferrous and non ferrous category.
 - (b) Write down the effects of various alloying elements such as Cr, Mn, Ni and V on mechanical properties of ferrous materials.
 - (c) Write down the difference between Edge and Screw dislocation.
 - (d) Briefly explain carburizing process.
 - (e) Write down the composition, property and usage of Duralumin.
 - (f) Differentiate between thermosetting and thermoplastic polymers.
 - (g) Briefly classify ceramics and write down their uses.

3. Draw Iron-Carbon phase diagram showing various micro-constituents and phases. 7+3
Briefly explain various reactions that occurs in a Iron-Carbon phase diagram.
4. (a) What are the purposes of Heat treatment process? 4
(b) Explain the following Heat treatment processes.
(i) Normalizing 6
(ii) Annealing
5. (a) Differentiate between Slip and Twinning. 5
(b) Write down various types of point defects and their causes. 5
6. Write down the composition,properties and uses of fiber reinforced composites. 10
7. Write short notes on 2.5×4
(i) Tool steel
(ii) Y-alloy
(iii) Iron-base spring material
(iv) Babbit metal

Th-4 Thermal Engineering-I

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer All questions 2 x 10
- a. State the Zeroth law of thermodynamics.
 - b. In which process work done is equal to heat transfer and how?
 - c. What is mechanical equivalent of heat?
 - d. Define intensive and extensive properties with example.
 - e. Define C.O.P of a refrigerator.
 - f. What is stroke length of an I.C engine?
 - g. Draw P-V and T-S diagram of otto cycle.
 - h. State Clausius's statement of 2nd law of thermodynamics.
 - i. Define cetane number.
 - j. State Boyle's law.
2. Answer Any Six Questions: 6 x 5
- a. Derive the relationship between Cp, Cv & R.
 - b. Differentiate between 2-stroke and 4-stroke engine.
 - c. State and explain the 1st law of thermodynamics.
 - d. Define fuel and explain the various classifications of fuels.
 - e. In a non-flow process, a gas expands from volume 1m³ to a volume of 2m³ according to the law $P = 2/v+1.5$, where P is the pressure at any point in its path in bar and V is the volume at the same point in m³. Determine (1) pressure at the end of expansion in KN/m² and (2) work done by the gas doing expansion in kj.
 - f. An ideal heat engine works on carnot cycle between the temperature limits of 327^oC and 77^oC. If 550kj of heat is supplied to the working medium during a cycle of operation then find the
(1) thermal efficiency of the cycle and
(2) quantity of heat rejected.
 - g. An engine working on Otto cycle has a cylinder diameter of 200mm and stroke of 300mm clearance volume is 1500000mm³. Determine the air standard efficiency for the engine.
3. What is an isothermal process? Derive an expression for the work done during isothermal process. 10
4. 0.12m³ of air at a temperature of 20^{0c} and pressure of 1.1bar is compressed to 20 bar according to the law $PV^{1.3}=c$. Determine the following: 10
- I. End volume
 - II. End temperature and
 - III. Work required for compression
5. An ideal diesel engine has a diameter 150mm and stroke 200mm. The clearance volume is 10 percent of the swept volume. Determine the compression ratio and the air standard efficiency of the engine is cut-off takes place at 6 percent of the stroke. 10
6. State the general energy equation of a gas for a steady flow process. 10
7. What is quasi-static process? 2
Explain briefly Otto cycle with the help of P-V and T-S diagram, and derive an expression for the ideal efficiency of Otto cycle. 8

TH 5 Environmental Studies

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define Environment.
 - b. Define deforestation.
 - c. What do you mean by decomposers?
 - d. What are hot spots of biodiversity?
 - e. Define eco system.
 - f. Write down psychological effect of noise pollution.
 - g. What is solid waste management?
 - h. Define green house effect.
 - i. What are the major reasons of population explosion?
 - j. What is Draught?
2. Answer **Any Six** Questions 6 x 5
 - a. What are causes of deforestation.
 - b. What are the environmental effects of mining.
 - c. Give a brief description about structures of a pond eco –system.
 - d. Discuss about 3R in controlling environmental pollution.
 - e. What is global warming ? Write down the effects of global warming?
 - f. Discuss about rain water harvesting?
 - g. What is the role of an individual in controlling pollution of environment?
3. What is the need of land resources? Write the main reasons of degradation of land? 10
4. What are the changes made in agriculture? Write down the impacts of modern agriculture on environment? 10
5. What are ecological pyramids? Explain the pyramid of number and pyramid of energy? 10
6. Explain the sources of solid waste and solid waste management? 10
7. Write short notes on 10
 - a. World food problem
 - b. Acid rain

**III-SEM/MECHANICAL/AUTO/AERO/DIP IN MECH/MECH(PROD)
/MECH(MAINT)/MECH(IND INTG)/MECH(SWICH)/ 2021(W)
TH-1 Production Technology**

Full Marks: 80

Time- 3 Hrs

Answer any **FIVE** Questions including **Q No.1&2**
Figures in the right-hand margin indicates marks

1. Answer **ALL** questions 2 x 10
 - a. What is metal forming?
 - b. Classify the welding process.
 - c. Name any four types of welding defects.
 - d. What do you mean by reusability of moulding sand?
 - e. What is meant by machining allowance in pattern making?
 - f. State the steps in core preparation.
 - g. Define sintering process.
 - h. What is trimming operation in press work?
 - i. Why jigs are needed in production process?
 - j. Define casting process.

2. Answer **Any SIX** Questions 5X6
 - a. Compare Plate fixture with Angle-plate fixture.
 - b. Describe briefly about progressive dies with a neat sketch.
 - c. Explain Compacting process in press work.
 - d. What do you mean by a hanging core? Explain briefly.
 - e. Differentiate between TIG & MIG welding process.
 - f. Discuss about different types of rolling process.
 - g. State the need of using flux in welding.

3. Describe Electric Arc Welding Process with neat sketch. 10
4. Discuss the working principle of Cupola Furnace. 10
5. Explain about different non-destructive tests carried out to detect casting defects. 10
6. Explain briefly the difference between Jigs with Fixtures. 10
7. Discuss briefly about the different secondary processes for producing components using powder metallurgy techniques. 10

III-SEM./MECH/AUTO/AERO/DIP IN MECH
/MECH(PROD/MECH(MAINT) /MECH(IND INTG) /
MECH(SWITCH)/ 2021(W)
TH-II Strength of Materials

Full Marks: 80

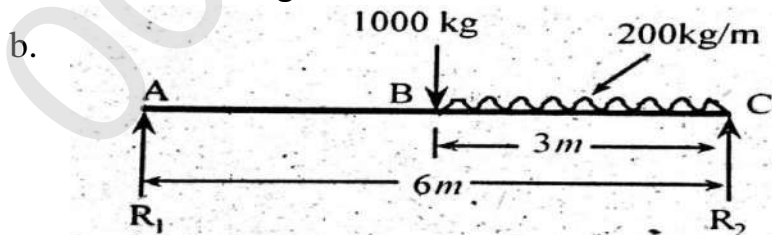
Time- 3 Hrs

Answer any **FIVE** Questions including **Q No.1&2**
Figures in the right-hand margin indicates marks

1. Answer **ALL** questions 2 x 10
- a. Define Stress.
 - b. State the Hook's Law.
 - c. Write down the expression for Strain Energy.
 - d. Define Hoop stress.
 - e. What do you understand by Principal Stresses?
 - f. Write the significance of Mohr's Circle.
 - g. State different types of beams.
 - h. What is pure bending?
 - i. Explain Crippling Load.
 - j. Define shaft.

2. Answer **Any SIX** Questions 5X6

- a. State the assumptions made in theory of bending.
Find the reactions of simply supported beam when a point load of 1000 kg and a uniform distributed load of 200 kg/m is acting on it as shown in figure below:



- c. Explain Temperature stress and derive its expression.
- d. Derive the torsion equation for a solid circular shaft.
A circular bar is subject an axial pull of 120 kN. If the maximum intensity of shear stress on any oblique plane is not to exceed 55 MN/m^2 , find the diameter of the bar.
- e.

- f. Find the generalized equation for Shear Force & Bending Moment of a simply supported beam with Uniformly Distributed Load.
A steel rod 22mm in diameter and 1.5meters long is subjected to an axial pull of 35 kN. Find i) The intensity of stress, ii) The strain & Elongation. Take $E=2 \times 10^5 \text{ N/mm}^2$
- g.

- 3 Derive the expression for Hoop Stress & Hoop Strain for thin spherical shells. 10
- 4 Find out the expression for Section Modulus for a i) Rectangular Section, ii) Hollow Rectangular Section, iii) Circular Section & iv) Hollow Circular Section. 10
- 5 Derive the relationship between the three modulus (Young's, Bulk & Shear). 10
- 6 The principal stresses at a point in a bar are 150 N/mm^2 (tensile) and 80 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. Also, find the maximum intensity of shear stress in the material at that point. 10
- 7 Derive the formulae for Crippling Load under various end conditions. 10

**3rd Sem./MECH/AUTO/AERO/DIP IN MECH/ MECH(PROD)/
MECH(MAINT)/ MECH(IND INTG)/ MECH(SWITCH)/ 2021(W)
Th4 Thermal Engg.-1**

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
- a. Define Point function and Path function.
 - b. What is mechanical equivalent of heat?
 - c. Define the Zeroth law of thermodynamics.
 - d. Explain the Clausius statement of 2nd law of thermodynamics.
 - e. State the Boyle's law and Charles's law.
 - f. Define enthalpy.
 - g. Define Piston speed and state its formula.
 - h. Draw the P-V and T-S diagram of Otto cycle.
 - i. Define Cetane number and Octane number.
 - j. What is meant by Free Expansion?
2. Answer **Any Six** Questions 5X6
- a. Explain the Thermodynamic systems.
 - b. Derive the steady flow energy equation.
 - c. Differentiate between SI and CI engine.
 - d. Classify and explain the different types of fuel.
 - e. Derive the relationship between C_p , C_v and R.
 - f. Define COP. Derive the relation between COP of Refrigerator and COP of Heat Pump.
 - g. An ideal gas at 30°C and 1bar is compressed adiabatically from 5m³ to 1m³. Find the temperature, pressure and work done. Take $\gamma=1.4$

- 3 Derive the efficiency of Otto cycle with P-V and T-S diagram. 10
- An ideal diesel cycle operates within the temperature limits of 1700K and 300K and with a compression ratio of 16. Determine the
- 4 (a) pressure and temperature at each point in the cycle 10
(b) thermal efficiency of the engine
(c) mean effective pressure
- Air flows steadily at the rate of 1kg/s through an air compressor entering at 7m/s velocity, 100kPa pressure and specific volume of 0.95m³/kg and leaving at 5m/s, 700kPa and 0.19m³/kg. The difference in internal energy between outlet and inlet is 90kJ/kg. Cooling water absorbs heat from the air at the rate of 60kW. Calculate
- 5 (a) rate of work input 10
(b) ratio of inlet and outlet pipe diameter
- 6 (a) What is the first law of thermodynamics? 10
(b) Derive the expression for the work done for an Isothermal process.
- 7 Explain the working principle of 2 Stroke and 4 Stroke SI engine with neat sketch. 10

3rd Sem. Common 2021(W)

Th-5 Environmental Studies

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define acid rain.
 - b. What is ecological succession?
 - c. What do you mean by soil erosion?
 - d. Define genetics and species.
 - e. Mention any two causes of marine pollution.
 - f. Define environment.
 - g. What is mortality?
 - h. What do you mean by sustainable development?
 - i. What leads to conflicts over water?
 - j. Define water pollution.

2. Answer **Any Six** Questions 6 x 5
 - a. Define and explain food chain with at least one example.
 - b. Explain the changes caused by modern agriculture.
 - c. Explain Biodiversity at National level.
 - d. Give a brief note on ozone layer depletion along with its consequences.
 - e. Discuss in brief 'Human Rights'.
 - f. Discuss the needs of public awareness towards environment.
 - g. Explain cyclone disaster management.

3. Explain the effects of mine extraction on environment and tribal people. 10
4. Explain different threats to biodiversity. 10
5. Describe forest ecosystem. 10
6. Write down the causes, effects and controlling measures of soil pollution. 10
7. a. Urban problems related to energy. 5
b. Family welfare program. 5

Th-1 Production Technology

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
- a. Define Impact extrusion process.
 - b. Define Rolling process and classify its various types.
 - c. Write different types of flames used in Oxy-acetylene welding process.
 - d. What is pattern? State different type of pattern in foundry shop.
 - e. State the function of flux in welding.
 - f. Define porosity and its remedies.
 - g. What is the function of chill and chaplet?
 - h. Define Powder Metallurgy process.
 - i. Define piercing and trimming.
 - j. What do understand by permeability?
2. Answer **Any Six** Questions 6 x 5
- a. State five numbers of welding defects, its causes and remedies.
 - b. Explain sintering process.
 - c. Explain different type of pattern allowances.
 - d. Differentiate between TIG and MIG welding process.
 - e. Explain different types of moulding sands with its compositions.
 - f. Explain Compound die and Progressive die.
 - g. What is Centrifugal casting? Explain with neat sketch.
3. Describe the construction and working principle of Cupola furnace with a neat sketch. 10
4. Explain 3-2-1 location of rectangular jig. 10
5. What is Resistance welding process? Explain Spot welding and Seam welding with a neat sketch. 10
6. Explain different type of Casting defects and its remedies. 10
7. Explain the process of Power Metallurgy. 10

3RD SEM./AERO/AIRCRAFT MAINT./AUTO/DME/ MECH./ MECH(MAINT.)/
MECH(PROD.)/ MECH(SAND.)/ MECH (IND.INT.)/ 2022(W)

Th-2 Strength of Material

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
- a. Define Poisson's ratio.
 - b. What is meant by Shear force diagram and Bending moment diagram?
 - c. Define the point of contra-flexure.
 - d. Define column.
 - e. What is meant by Temperature stress?
 - f. What do you mean by Section modulus?
 - g. Define Principal Stress and Principal Plane.
 - h. What is the function of shaft? Write down the formula for power transmitted by a shaft.
 - i. Define cantilever beam with example.
 - j. What is meant by thin cylinder shell? State its application.
2. Answer **Any Six** Questions 6 x 5
- a. A hollow cylinder 2m long has an outside diameter of 50mm and inside diameter of 30mm. If the cylinder is carrying a load of 25kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the modulus of elasticity for the cylinder material is 100GPa.
 - b. The stresses at point of a machine component are 150MPa and 50MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55° with the axis of major tensile stress.
 - c. Show diagrammatically different types of beams and loads.
 - d. What are the various assumptions taken while deriving bending equations under theory of simple bending?
 - e. Derive a formula for the longitudinal stress in a thin cylindrical shell subjected to an internal pressure.
 - f. Write down the assumption taken for finding out the torsion formula.
 - g. A solid circular shaft of 100mm diameter is transmitting 120kW at 150 rpm. Find the intensity of shear stress in the shaft.

- 3 Prove 10
 $E = 3k(1 - 2/m)$
Where E = Young's modulus
K = Bulk modulus
 $1/m =$ Poisson's ratio
- 4 Prove the relation 10
 $m/I = \sigma/y = E/R$
where m = Bending moment
I = Moment of inertia
 $\sigma =$ Bending stress in a fibre at a distance y from the neutral axis
E = young's modulus
R = Radius of curvature
- 5 A cantilever beam AB, 2m long carries a uniformly distributed load of 1.5kN/m over a length of 1.6m from the free end. Draw the shear force diagram and bending moment diagram for the beam. 10
- 6 A cylindrical shell of 1.3m diameter is made up of 18mm thick plates. Find the circumferential and longitudinal stress in the plates, if the boiler is subjected to an internal pressure of 2.4MPa. Take efficiency of the joints as 70%. 10
- 7 A rectangular beam 60mm wide and 150mm deep is simply supported over a span of 6m. If the beam is subjected to central point load of 12KN. Find the maximum bending stress induced in the beam section. 10

Th3 Engineering Material

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Classify the engineering material.
 - b. Give two examples of each of ferrous and non-ferrous materials.
 - c. Define crystal and ideal crystal.
 - d. What is an alloy?
 - e. Name the various heat treatment processes.
 - f. What is meant by thermosetting polymers?
 - g. Write the purpose of heat treatment process.
 - h. What is point defect?
 - i. What is elastomer?
 - j. What is dislocation?

2. Answer **Any Six** Questions 6 x 5
 - a. Write down the difference between Edge dislocation and Screw dislocation.
 - b. Differentiate between thermosetting and thermoplastic polymers.
 - c. Give a brief classification of ceramics and write down their uses.
 - d. State the composition and properties of Duralmin and Y-alloy.
 - e. Differentiate between slip and twinning.
 - f. Briefly explain the cooling curves for a material with a neat diagram.
 - g. What is effect of various alloying elements such as Cr, Mn, Ni,V and Mo?

3. Explain the iron carbon equilibrium diagram with salient micro constituents of iron and steel with a neat diagram. 10

4. Describe in detail the composition, properties and uses of tin based bearing material. 10

5. Explain in brief the following heat treatment processes: 10
 - (i) Annealing
 - (ii) Hardening

6. Explain various mechanical properties of engineering materials. 10

7. Describe in detail the composition, properties and use of a copper base spring material. 10

3RD SEM. / COMMON / 2022(W)

Th-5 Environmental studies

Full Marks: 80

Time- 3 Hours

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define natural resources.
 - b. Write down two examples of non-renewable resources.
 - c. Define soil erosion.
 - d. Define producers in eco system.
 - e. What is bio diversity?
 - f. What do you mean by poaching of wild life?
 - g. What is the unit of sound intensity?
 - h. What is endangered species.
 - i. Define greenhouse effect.
 - j. What are the various objectives of family welfare programme.

2. Answer **Any Six** Questions 6 x 5
 - a. What are the environmental effects of mining?
 - b. Give a brief description of man wild life conflict.
 - c. What are the effects of acid rain.
 - d. Define rainwater harvesting? State the objective of rain water harvesting?
 - e. Describe about Bio gas plant.
 - f. Write down the role of an individual protecting environment.
 - g. What are the effects of modern agriculture?

3. Define Global warming, write down the causes and effect of global warming. 10
4. Explain sources of solid waste and solid waste management. 10
5. Describe aquatic ecosystem. 10
6. Write down the effect, prevention and control of noise pollution. 10
7. Write short notes on 10
 - a. Pyramid of energy
 - b. Green house effect