

**B.L.D.E.A's V.P.Dr.P.G.HALAKATTI COLLEGE OF ENGINEERING AND  
TECHNOLOGY VIJYAPUR 586103**

**INDEX FILE 7 & 8<sup>th</sup> SEMESTER QUESTION PAPERS JAN/FEB 2023**

**5<sup>th</sup>, 7<sup>TH</sup> and 8<sup>th</sup> SEMESTER**

**AUTOMOBILE DEPARTMENT**

<b>S.No</b>	<b>SUB CODE</b>	<b>SUBJECT CODE</b>	<b>PAGE No</b>
1	18AU52	Dynamics of Machines	1-3
2	18AU53	Design of Machine Elements-I	4-7
3	18AU54	Automotive Fuels and Combustion	8-9
4	18AU55	Automotive Transmission	10-11
5	18AU56	Hydraulics and Pneumatics	12
6	18AU71	Finite Element Modeling and Analysis	13-15
7	18AU732	Earth Moving equipments and Tractors	16-17
8	18AU742	Operation Research	18-20
9	18AU751	Engineering Economics and Cost Estimation	21-22
10	18AU752	Total Quality Management	23
11	18IP752	Automotive Engineering	24-25

18V Sem AU

# CBGS SCHEME

B.L.D.E. ASSOCIATION'S  
VACHANA PITAMBAHA  
DR. P.C. HILAKATTI  
COLLEGE OF ENGINEERING  
LIBRARY, BIJAPUR. 18AU52

USN 

--	--	--	--	--	--	--	--	--	--

## Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Dynamics of Machines

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. With neat sketches, discuss the static equilibrium of the following :
  - i) Two force members
  - ii) Two force and a torque members
  - iii) Three force members
  - iv) Four force members

(08 Marks)
- b. A slider crank mechanism is as shown below. A force of 1000 N is applied to the piston when the crank is at 60° from the IDC. Calculate the driving torque  $T_2$ . Also calculate all forces [Refer Fig.Q1(b)]

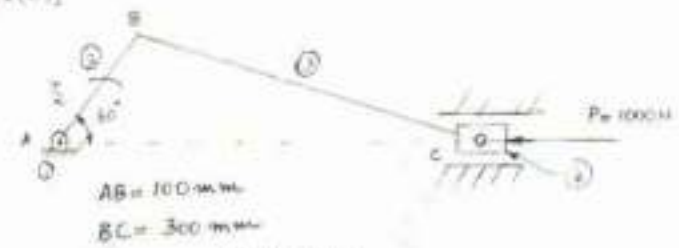


Fig.Q1(b)

(12 Marks)

OR

- 2 a. State and explain D'Alembert's principle. (05 Marks)
- b. The crank and the connecting rod of a vertical single cylinder gas engine running at 1800rpm are 60mm and 240mm respectively. The diameter of the piston is 80mm and the mass of the reciprocating parts is 1.2 kg. At a point during the power stroke when the piston has moved 20mm from the top dead centre position, the pressure on the piston is 800 kN/m<sup>2</sup>. Find
  - i) Net force on the piston
  - ii) Thrust in the connecting rod
  - iii) Thrust on the sides of cylinder walls
  - iv) Engine speed at which the above values are zero.

(15 Marks)

### Module-2

- 3 a. What is meant by static balancing and dynamic balancing? (06 Marks)
- b. Four masses  $M_1 = 100$  kg;  $M_2 = 175$  kg;  $M_3 = 200$  kg and  $M_4 = 125$  kg are fixed to the crank of 200mm radius and revolve in planes 1, 2, 3 and 4 respectively. The angular positions of the planes 2, 3 and 4 with respect to 1 are 75°, 135° and 240° taken in the same sense. Distances of the planes 2, 3 and 4 from 1 are 600mm, 1800mm and 2400mm. Determine the magnitude and position of the balancing masses at a radius of 600mm in planes 'L' and 'M' located in the middle of 1 and 2 in the middle of 3 and 4 respectively. (14 Marks)

OR

- 4 a. For partial primary balancing, derive an expression for the residual unbalanced force at a given instant. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written e.g. 4.2 x 8 = 50, will be treated as malpractice.

- b. A 5 cylinder inline engine running at 500 rpm has successive cranks at  $144^\circ$  apart. The distance between the cylinder center line is 300mm. The piston stroke = 240mm, length of connecting rod = 480mm. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of the central crank at which these maximum values occur. The reciprocating mass for each cylinder is 150N. (15 Marks)

**Module-3**

5. a. What are the distinct features which differentiate flywheels from governors? (02 Marks)  
 b. Define coefficient of fluctuation of speed and coefficient of fluctuation of energy. (04 Marks)  
 c. A three cylinder single acting engine has its cranks set equally at  $120^\circ$  and it runs at 600 rpm. The torque crank angle diagram for each cycle is a triangle for the power stroke with a maximum torque of 90 N-m at  $60^\circ$  from the top dead centre of the corresponding crank. The torque on the return stroke is sensibly zero. Determine  
 i) Coefficient of fluctuation of speed  
 ii) Coefficient of fluctuation of energy. (14 Marks)

**OR**

6. a. Define the following with respect to governors:  
 i) Sensitiveness  
 ii) Governor Effect  
 iii) Governor Power  
 iv) Hunting  
 v) Stability  
 vi) Isochronous Governor. (06 Marks)  
 b. Explain the working principle of a simple centrifugal governor. (04 Marks)  
 c. A porter governor has all 4 arms 300mm long, the upper arms are pivoted on the axis of rotation and lower arms are attached to the sleeve at a distance 35mm from axis. The mass of each ball is 7Kg and the load on the sleeve is 540N. Determine the equilibrium speed for the two extreme radii of 200mm and 260mm of rotations. (10 Marks)

**Module-4**

7. a. Derive an expression for the total frictional torque of a conical pivot bearing considering uniform wear and uniform pressure. (10 Marks)  
 b. In a thrust bearing, the external and the internal diameter of the contact surface are 300mm and 200mm respectively. The total axial load is 100 kN and the intensity of pressure is  $250 \text{ kN/m}^2$ . The speed of the shaft is 500 rpm and the coefficient of friction = 0.05. Calculate  
 i) Number of collars required  
 ii) Power lost due to friction, assuming uniform pressure theory. (10 Marks)

**OR**

8. a. With usual notation, derive the expression  $\frac{T_1}{T_2} = e^{\mu\theta}$ . (10 Marks)  
 b. Belt of 100mm width and 10mm thick is transmitting power at 1000 m/min. The net driving tension is 1.8 times the tension on the slack side. If the safe permissible stress is 2 MPa, calculate the maximum power that can be transmitted at this speed. Assume the density of leather as  $1000 \text{ kg/m}^3$ . Also calculate the absolute max. power that can be transmitted by this belt and the speed at which this can be transmitted and the percentage increase in the power. (10 Marks)

**Module-5**

- 9 a. Derive an expression for stability of a two wheeler negotiating a curve. (08 Marks)
- b. Each wheel of a four wheeler, rear engine automobile has a moment of inertia of  $2.4 \text{ kgm}^2$  and an effective diameter of 660 mm. The rotating parts of the engine has a moment of inertia of  $1.2 \text{ kgm}^2$ . The gear ratio of the engine to back axle is 3:1. The engine axis is parallel to the rear axle and the crank shaft rotates in the same sense as that of the road wheel. The mass of the vehicle is 2200 kg and the centre of mass is 550 mm above the road level. The track width of the vehicle is 1.5m. Determine the limiting speed of the vehicle around a curve with 80 m radius so that all the four wheels maintain contact with the road surface. (12 Marks)

**OR**

- 10 a. Derive an expression for the displacement, velocity and the acceleration of the follower when the roller is in contact with straight flank. (10 Marks)
- b. Derive an expression for the displacement, velocity and the acceleration when the flat face of the follower has contact on the circular flank. (10 Marks)

\*\*\*\*\*

USN

--	--	--	--	--	--	--	--	--	--

18AU53

## Fifth Semester B.E. Degree Examination, Jan./Feb. 2023

### Design of Machine Elements – I

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
 2. Use of design data handbook is permitted.  
 3. Assume missing data suitably.*

#### Module-1

1. a. A point in a structural member subject to plane stress as shown in Fig.Q1(a). Determine the following:
- (i) Normal and tangential stress on plane MN inclined at an angle of  $45^\circ$ .
  - (ii) Principal stress and their direction.
  - (iii) Maximum shear stress and the direction of the plane on which it occurs.

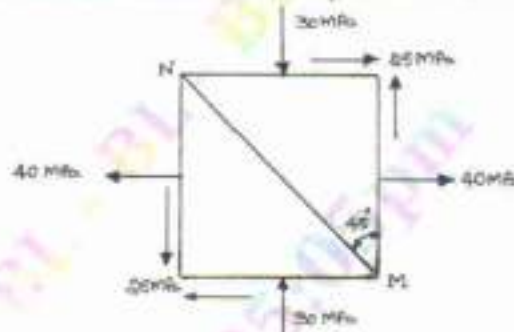


Fig.Q1(a)

(10 Marks)

- b. A mild steel bracket shown in Fig.Q1(b) is subjected to a pull of 10 kN. The bracket has rectangular cross-section whose depth is twice the width. If the allowable stress for the material is  $80 \text{ N/mm}^2$ . Determine cross-section of the bracket.

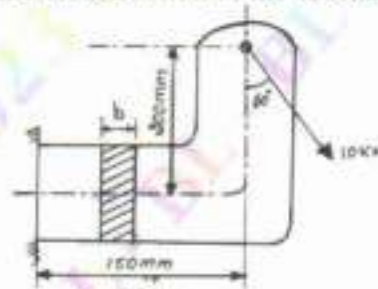


Fig.Q1(b)

(10 Marks)

OR

2. a. A circular rod of diameter 50 mm is subjected to loads as shown in Fig.Q2(a). Determine the nature and magnitude of stress at the critical points.

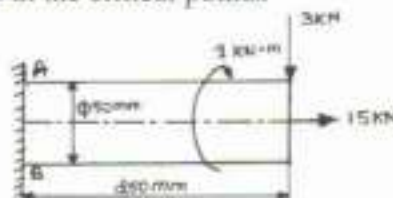


Fig.Q2(a)

(10 Marks)

- b. A mild steel shaft of 60 mm diameter is subjected to a bending moment of  $25 \times 10^3$  N-m and torque ' $M_t$ '. If the yield point of steel in tension is  $230 \text{ N/mm}^2$ , find the maximum value of the torque without causing yielding of shaft according to:
- Maximum principal stress theory of failure
  - Maximum shear stress theory of failure
  - Maximum distortion energy theory of failure
- Adopt a factor of safety of 1.5. (10 Marks)

### Module-2

- 3 a. A notched flat plate shown in Fig.Q3(a) is subjected to bending moment of 10 N-m. Determine the maximum stress induced in the member by taking the stress concentration into account.

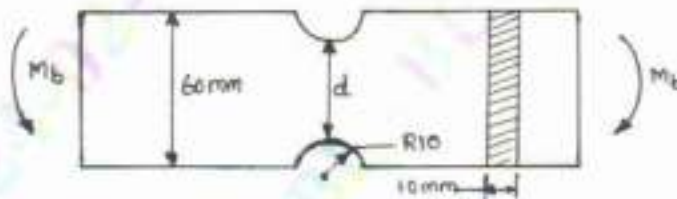


Fig.Q3(a)

(10 Marks)

- b. Determine the power that can be transmitted by a shaft as shown in Fig.Q3(b). Speed of shaft is 1200 rpm, if the allowable shear stress is  $50 \text{ N/mm}^2$ .

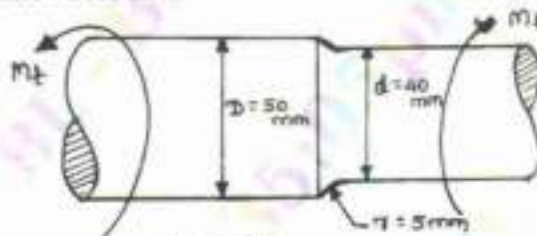


Fig.Q3(b)

(10 Marks)

OR

- 4 a. An unknown weight fall through 20 mm on to a collar rigidly attached to the lower end of a vertical bar of mild steel of 2m long and  $500 \text{ mm}^2$  section. If the maximum instantaneous extension is known to be 2 mm, what is the corresponding stress and the value of unknown weight? (10 Marks)
- b. A steel rod (SAE 9620 oil quenched) is subjected to a tensile load which varies from 120 kN to 40 kN. Design the safe diameter of the rod using "Soderberg diagram". Adopt factor of safety as 2. Stress concentration factor as unity and correction factor for load, size and surface as 0.75, 0.85 and 0.91 respectively. Take,  $\sigma_{ut} = 1089.5 \text{ MPa}$ ,  $\sigma_{yt} = 689.4 \text{ MPa}$  and  $\sigma_{-1} = 427 \text{ MPa}$ . (10 Marks)

### Module-3

- 5 a. Design a knuckle joint to connect two mild steel rods subjected to an axial pull of 100 kN. The allowable stress for rods and pins are 100 MPa, 130 MPa and 60 MPa in tension crushing, and shear respectively. The bending of the pin is prevented by selection of proper fit. (10 Marks)
- b. A flange coupling used to connect two co-axial shafts of diameter 80 mm to transmit 60 kW at 200 rpm, 6 bolts of  $M14 \times 1.5$  are used on a bolt circle diameter of 240 mm. The stress in key is 80 MPa and the hub diameter is 150 mm and flange thickness is 20 mm. Determine shear stress induced in Shaft, Bolt, Key and Flange. (10 Marks)

OR

6. A horizontal piece of commercial shafting is supported by two bearings 1.5 m apart. A keyed gear 20° involute and 175 mm in diameter is located 400 mm to the left of the right bearing and is driven by a gear directly behind it. A 600 mm diameter pulley is keyed to the shaft 600 mm to the right of the left bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of belt is 3 to 1, with the slack side on top. The drive transmits 45 KW at 330 rpm. Take  $K_b = K_t = 1.5$ . Calculate the necessary diameter of the shaft and angular deflections in degrees. Use allowable shear stress 40 MPa and  $G = 80 \times 10^9 \text{ N/m}^2$ . (20 Marks)

**Module-4**

7. a. A double riveted lap joint is to be made between 9 mm plates. If the safe working stress in tension, crushing and shear are 80 N/mm<sup>2</sup>, 120 N/mm<sup>2</sup> and 60 N/mm<sup>2</sup> respectively, design the riveted joint. (10 Marks)  
 b. Determine the diameter of rivet for the joint shown in Fig.Q7(b). The allowable stress in the rivets is 100 N/mm<sup>2</sup>.

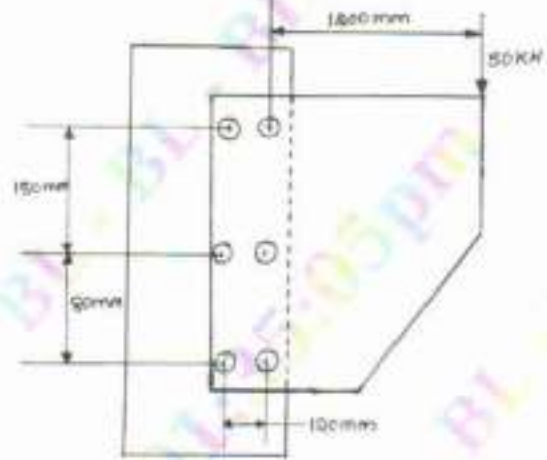


Fig.Q7(b)

(10 Marks)

OR

8. a. A plate of 80 mm wide and 15 mm thick is joined with another plate by a single transverse weld and a double parallel weld. Determine the length of parallel fillet weld if the joint is subjected to both static and fatigue loading. Take  $\sigma_t = 90 \text{ MPa}$ ;  $\tau = 55 \text{ MPa}$  as the allowable stress and stress concentration factor as 1.5 for transverse and 2.7 for parallel weld. (10 Marks)  
 b. Determine the size of weld required for an eccentrically loaded weld as shown in Fig.Q8(b). The allowable stress in the weld is 75 N/mm<sup>2</sup>.

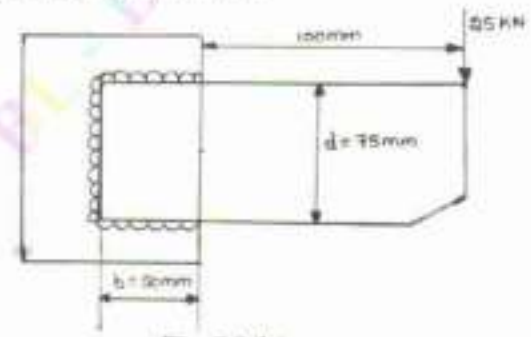


Fig.Q8(b)

(10 Marks)

**Module-5**

- 9 a. A bracket shown in Fig.Q9(a) carries a load of 50 kN. Determine the size of bolt if the permissible tensile stress in the bolt material is  $200 \text{ N/mm}^2$ .

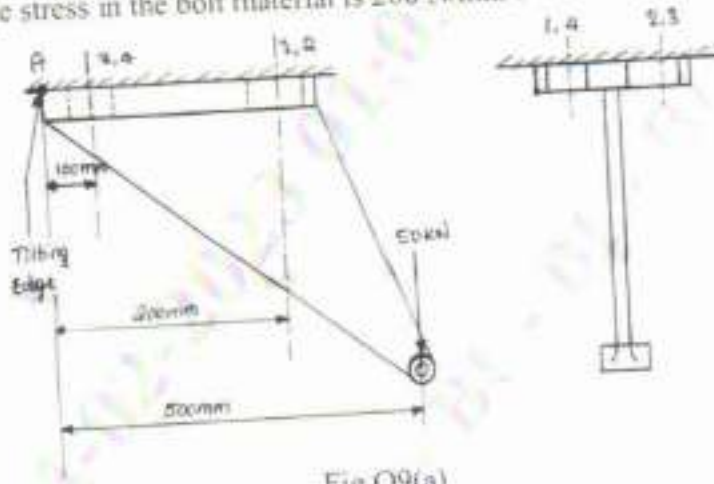


Fig.Q9(a)

(10 Marks)

- b. A bracket is fixed to the wall by means of four bolts and loaded as shown in Fig.Q9(b). Calculate the size of the bolts. If the load is 10 kN and allowable shear stress in the bolt material is 40 MPa.

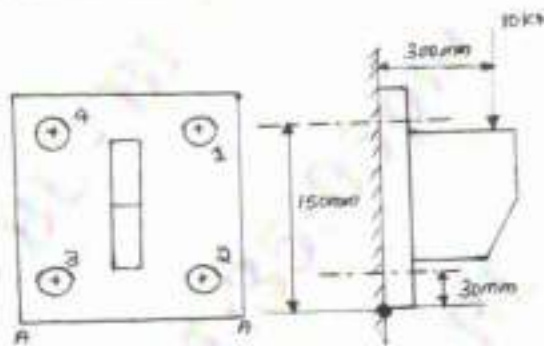


Fig.Q9(b)

(10 Marks)

**OR**

- 10 a. A flat circular plate is used to close the flanged end of a pressure vessel of internal diameter 300 mm. The vessel carries a fluid at a pressure of  $0.7 \text{ N/mm}^2$ . A soft copper gasket is used to make the joint leak proof. Twelve bolts are used to fasten the cover plate onto pressure vessel. Find the size of bolts so that the stress in the bolts is not to exceed  $100 \text{ N/mm}^2$ . (10 Marks)
- b. Derive an expression for torque required to raise a load and lower a load in power screws. (10 Marks)

\*\*\*\*\*



USN

--	--	--	--	--	--	--	--	--	--

**Fifth Semester B.E. Degree Examination, Jan./Feb. 2023**  
**Automotive Fuels and Combustion**

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

**Module-1**

- 1 a. Write a short note on : (10 Marks)
  - i) Bio-Energy ii) Synthetic fuels.
- b. Explain the following : (10 Marks)
  - i) Cracking ii) Polymerization iii) Flash and fire point iv) Diesel index.

**OR**

- 2 a. Explain briefly solar energy and Geo-thermal energy with block diagram. (10 Marks)
- b. Explain with neat sketch, the refining process of petroleum. (06 Marks)
- c. List the various properties of liquid fuels. Explain any two in brief. (04 Marks)

**Module-2**

- 3 a. Describe briefly properties and rating of fuels in IC engines. (10 Marks)
- b. Explain the fuel gas analysis by gas chromatography. (10 Marks)

**OR**

- 4 a. Explain the working of Orsat Apparatus with a neat sketch. (10 Marks)
- b. Explain the production process of Biodiesel. List out the advantages and disadvantages of biodiesel. (10 Marks)

**Module-3**

- 5 a. Discuss the effects of engine variables on ignition lag. (10 Marks)
- b. With neat sketch, explain the stages of combustion in S.I engines. (10 Marks)

**OR**

- 6 a. Discuss the effects of engine variables on flame propagation. (10 Marks)
- b. List the different types of combustion chamber. Explain any one with neat sketch. (06 Marks)
- c. List the different effects of detonations and controlling methods of the same. (04 Marks)

**Module-4**

- 7 a. What is dynamometer? Explain with a neat sketch of Eddy current dynamometer. (10 Marks)
- b. A 6-cylinder petrol engine operates on the four-stroke cycle. The bore of each cylinder is 70mm and the stroke 100mm. The clearance volume per cylinder is  $67\text{cm}^3$ . At a speed of 3960rpm the fuel consumption is 19.5Kg/h and the torque developed is 140Nm. Calculate : (10 Marks)
  - i) the brake power ii) brake mean effective pressure iii) Brake thermal efficiency if C.V of the fuel is 44000 kJ/Kg iv) Relative efficiency on a brake power basis assuming the engine works on the constant volume cycle. Assume  $r = 1.4$  for air.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 8 a. List the basic measurement of engine Testing. Explain briefly Fuel consumption measurement. (10 Marks)
- b. A gas engine working on the constant volume cycle gave the following results during a one-hour test run. Cylinder diameter 24cm ; Stroke 48cm, effective diameter of brake wheel 1.25m. Net load on brake 1236N ; average speed 226.7rpm, average explanation per minute, 77 ; mep of indicator cards 7.5bar, gas used  $13\text{m}^3$  at  $15^\circ\text{C}$  and 771mm of mercury pressure ; lower calorific value of gas  $22000\text{kJ/m}^3$  at N.T.P cooling water used 625Kg, inlet temperature  $25^\circ\text{C}$ . Outlet temperature  $60^\circ\text{C}$ . Determine :
- The mechanical efficiency
  - The gas consumption in  $\text{m}^3$  at N.T.P per i.p hour
  - The indicated thermal efficiency
  - Draw up a heat balance for the engine on minute basis. (10 Marks)

Module-5

- 9 a. Discuss the five factors affecting combustion in dual fuel engines. (10 Marks)
- b. Explain modification required for fuel system of multifuel engine. (10 Marks)

OR

- 10 a. Discuss the working of dual fuel engine. State its advantages and disadvantages. (10 Marks)
- b. What are the modification required to use CNG as fuel in diesel engine? (10 Marks)

\*\*\*\*\*

USN

--	--	--	--	--	--	--	--	--	--

18AU55

## Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Automotive Transmission

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Explain design details of cone clutch based on uniform rate of wear. (10 Marks)  
 b. A multiplate clutch is to be designed for a motor cycle whose engine develops maximum torque of 3 Nm at 3500 rpm. The external diameter of the clutch racing is limited to 100 mm and the inner diameter may be assumed to be 0.6 times the external diameter. The maximum intensity of pressure may be taken as 80 kPa and  $\mu = 0.3$ . Calculate the number of plate. (10 Marks)

OR

- 2 a. Sketch and explain the construction and working principle of centrifugal clutch. (10 Marks)  
 b. Sketch and explain the construction and working principle of vacuum operated clutch. (10 Marks)

### Module-2

- 3 a. Sketch and explain the construction and working principle of fluid flywheel. (10 Marks)  
 b. With the help of graph, discuss the performance characteristics of a torque converter. (10 Marks)

OR

- 4 a. What is unidirectional clutch? Explain any two. (10 Marks)  
 b. Explain 3 and 4 phase torque converter with sketch and write the advantages. (10 Marks)

### Module-3

- 5 a. Briefly discuss the various resistance to motion of the automobile. How can these resistance be minimized? (10 Marks)  
 b. Explain the following :  
 (i) Traction and tractive effort  
 (ii) Acceleration grade ability  
 (iii) Draw bar pull (10 Marks)

OR

- 6 a. A motor vehicle weighs 7975.5 N and its engine develops 14.7 KW at 2500 rpm, at this engine the road speed of the car on the top gear is 64.37 km/h. Bottom gear reduction is 3.5:1 and the efficiency of transmission is 88% on top and 80% on bottom gear. The diameter of tyres is 0.762 m and the projected front area of the vehicle is 1.116 m<sup>2</sup>. The coefficient of air resistance is 0.0314 and road resistance is 0.023 N. (10 Marks)  
 b. Sketch and explain the construction and working principle of 3-speed synchromesh gear box. (10 Marks)

**Module-4**

- 7 a. The input shaft of an epicyclic type of gear box has two sun wheels each with 25 teeth splined to the shaft. Their corresponding angular ring have 100 teeth each. The output shaft has a sun running free on that shaft with 40 teeth while the corresponding annular ring has 80 teeth. Calculate the direct, second and reverse gear ratios. (06 Marks)
- b. Explain the basic principle of epicyclic transmission. (04 Marks)
- c. Briefly explain the principle of simple epicyclic gear train with sketch. Show that more number of gear ratios are possible from it. (10 Marks)

**OR**

- 8 a. What is overdrive? Explain its use in automobile. (10 Marks)
- b. Explain the construction and working of the Wilson planetary transmission. (10 Marks)

**Module-5**

- 9 a. Explain the functioning of the hydraulic control in an epicyclic planetary gear system. (10 Marks)
- b. Write short notes on:  
 (i) Constant displacement pump and constant displacement motor  
 (ii) Variable displacement pump and variable displacement motor. (10 Marks)

**OR**

- 10 a. With a neat diagram, explain the working of Borge Warner automatic transmission system. (10 Marks)
- b. Explain the basic working principle of hydrostatic drives. (10 Marks)

\*\*\*\*\*

# CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

18AU56

## Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Hydraulics and Pneumatics

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Define Pascal's law with neat sketch. (06 Marks)  
b. Explain pumping theory. (06 Marks)  
c. With neat sketch, describe the variable displacement pump (any one). (08 Marks)

OR

- 2 a. List and briefly explain linear hydraulic actuators of single acting cylinder type. (10 Marks)  
b. Discuss classification of positive displacement pumps with advantages. (10 Marks)

### Module-2

- 3 a. Explain 3/2 - way valve DCV of 3 ports and 2 position. (10 Marks)  
b. List and explain the desirable properties of hydraulic oils. (10 Marks)

OR

- 4 a. Discuss the pressure compensated flow control valve with neat sketch. (10 Marks)  
b. Classify the filters in hydraulic system. (05 Marks)  
c. Explain Beat ratio and Beat efficiency. (05 Marks)

### Module-3

- 5 a. What is regenerative circuit? Discrete with neat sketch. (10 Marks)  
b. Discuss the double acting hydraulic cylinder with sketch. (10 Marks)

OR

- 6 a. With neat sketch, explain pilot operated pressure control valve. (10 Marks)  
b. List hydraulic accumulators and explain spring loaded accumulator. (10 Marks)

### Module-4

- 7 a. Discuss the advantages and disadvantages of compressed air. (10 Marks)  
b. Explain with sketch the poppet valves. (10 Marks)

OR

- 8 a. Classify the air cylinders and explain briefly any four. (10 Marks)  
b. Describe Quick Exhaust Valve with line diagram. (10 Marks)

### Module-5

- 9 a. Discuss the applications of multi-cylinders of coordinated motion control type. (10 Marks)  
b. Explain principle of cascade system. (10 Marks)

OR

- 10 Write notes on:  
a. Relay  
b. Contractor  
c. Control Valves (speed/flow)  
d. Sequential motion control (20 Marks)

\*\*\*\*\*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or questions written e.g. 42+8 = 50, will be treated as malpractice.

USN

--	--	--	--	--	--	--	--	--	--

**Seventh Semester B.E. Degree Examination, Jan./Feb. 2023**  
**Finite Element Modeling and Analysis**

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

**Module-1**

- Derive the equilibrium equation for 3D elastic body. (10 Marks)
  - For the spring system shown in Fig Q1(b). Using principle of minimum potential energy, determine the Nodal displacement take  $F_1 = 70\text{N}$  and  $F_2 = 105\text{N}$

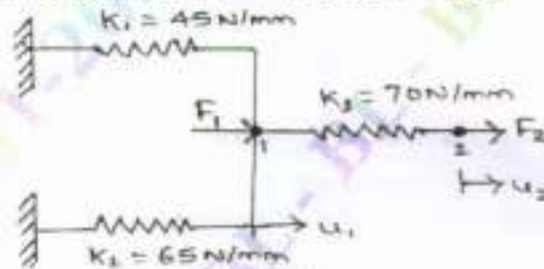


Fig Q1(b)

(10 Marks)

**OR**

- With neat sketch, explain plane stress and plain strain. Also state the assumptions. (10 Marks)
  - A bar of length  $L$ , cross sectional Area  $A$  and modulus of elasticity  $E$ , is subjected to distributed axial load  $q = cx$ , where  $C$  is a constant as shown in Fig Q2(b). Determine the displacement of the bar at the end using Rayleigh - Ritz method.

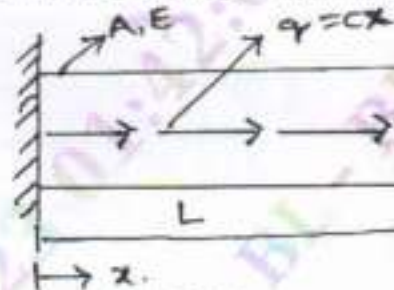


Fig Q2(b)

(10 Marks)

**Module-2**

- Use the Galerkin's method to obtain the approximate solution of the differential equation  $\frac{d^2y}{dx^2} - 10x^2 = 5$   $0 \leq x \leq 1$ . With boundary condition  $y(0) = y(1) = 0$ . Take the trial functions as  $N_1(x) = x(x - 1)$  and  $N_2(x) = x^2(x - 1)$ . (10 Marks)
  - Explain basic steps involved in FEM. (10 Marks)

**OR**

- Explain the stiffness matrix. Derive the stiffness matrix for the Bar element. (10 Marks)
  - Derive the shape-functions for Linear bar element in natural coordinates. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written esp. 42+8 = 50, will be treated as malpractice.

**Module-3**

- 5 a. Determine the Nodal displacement vector for the bar shown in Fig Q5(a), using penalty approach of handling boundary conditions.

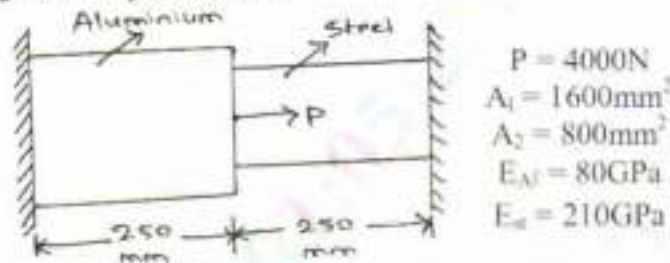


Fig Q5(a)

(10 Marks)

- b. Solve the following system of simultaneous equation by Gaussian elimination method.

$$x_1 - 2x_2 + 6x_3 = 0$$

$$2x_1 + 2x_2 + 3x_3 = 3$$

$$-x_1 + 3x_2 = 2$$

(10 Marks)

**OR**

- 6 a. Define Truss. State assumptions made in analysis of trusses. (04 Marks)
- b. For the two bar truss shown in Fig Q6(b), determine the nodal displacement and the stress in each member. Also find the support reaction. Take  $E = 200\text{GPa}$ .

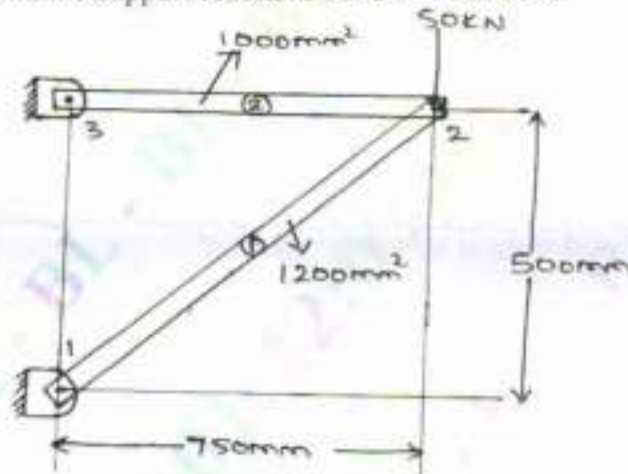


Fig Q6(b)

(16 Marks)

**Module-4**

- 7 a. With line diagram, explain isoparametric sub and superparametric elements. (10 Marks)
- b. Derive the shape functions for a three noded quadratic bar element. (10 Marks)

**OR**

- 8 a. Derive the shape function for two noded bar element (one dimensional) using Lagrangian polynomial. (10 Marks)
- b. Write a short note on : (10 Marks)
- Properties of shape functions
  - Lagrange interpolation function

## Module-5

- 9 a. Fig Q9(a) shown a simply supported beam subjected to a uniformly distributed load, obtain the maximum deflection. Take  $E = 200\text{GPa}$  and  $I = 2 \times 10^6 \text{mm}^4$ .

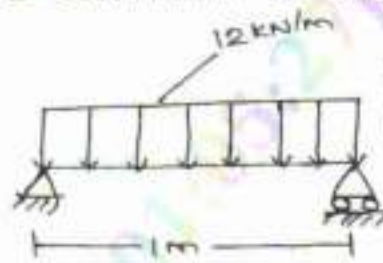


Fig Q9(a)

(10 Marks)

- b. A uniform cross sectional beam is fixed at one end supported by a roller at the other end. A concentrated 20kN is applied at the mid length of the beam as shown in Fig Q9(b). Determine the deflection under load. Take  $E = 210\text{GPa}$  and  $I = 2500 \text{mm}^4$ .

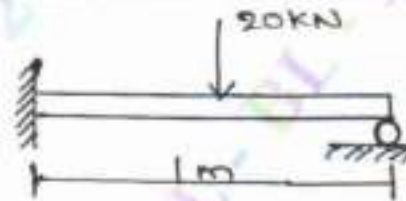


Fig Q9(b)

(10 Marks)

OR

- 10 a. Obtain differential equation for 1D Heat conduction. (06 Marks)  
 b. Explain Heat transfer in thin fins. (04 Marks)  
 c. Solve for temperature distribution in the composite wall as shown in Fig Q10(c), using 1-D heat elements. use penalty approach of handling boundary condition.

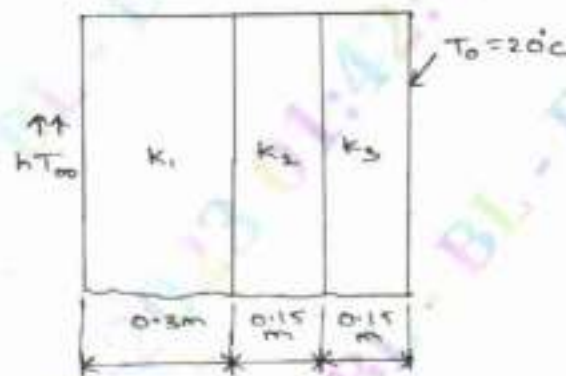


Fig Q10(c)

$$\begin{aligned} K_1 &= 20 \text{ W/m}^\circ\text{C} \\ K_2 &= 30 \text{ W/m}^\circ\text{C} \\ K_3 &= 50 \text{ W/m}^\circ\text{C} \\ T_r &= 800^\circ\text{C} \\ h &= 25 \text{ W/m}^2\text{C} \end{aligned}$$

(10 Marks)

\*\*\*\*\*



--	--	--	--	--	--	--	--	--	--

## Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Earth Moving Equipment and Tractors

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. List out the types of earthmoving equipments, with their respective applications. (10 Marks)
- b. Draw a layout of Dozer and explain about different components. (10 Marks)

### OR

- 2 a. Explain the working of following with line diagrams:  
i) Excavator    ii) Roller. (10 Marks)
- b. Discuss about the special features of tractors with applications. (10 Marks)

### Module-2

- 3 a. Compare track type Vs wheel type vehicles. (06 Marks)
- b. Explain the following systems adopted in earth moving vehicle engines:  
i) Turbochargers  
ii) After coolers. (14 Marks)

### OR

- 4 a. Explain the undercarriage components of a track type vehicle, with their functions. (10 Marks)
- b. Discuss the following:  
i) Rubber spring suspension  
ii) Air spring suspension. (10 Marks)

### Module-3

- 5 a. Name the types of transmissions and explain any one type with sketch. (12 Marks)
- b. Explain the hydroshift mechanism. (08 Marks)

### OR

- 6 a. Compare single reduction Vs double reduction drive systems. (10 Marks)
- b. Discuss the functions of PTO shaft with sketch. (10 Marks)

### Module-4

- 7 a. List out the components of hydraulic system and highlight their functions in brief. (08 Marks)
- b. Explain the functions of following in hydraulic system:  
i) Flow control valves  
ii) Direction control valves  
iii) Pressure control valves. (12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

**OR**

- 8 a. Write short notes about:  
i) Hydraulic motors (08 Marks)  
ii) Hydraulic cylinders. (12 Marks)
- b. With the aid of a neat sketch, explain the working of depth and draft control system. (12 Marks)

**Module-5**

- 9 a. Discuss about the criterion for selection of earth moving equipment based on the type of soil. (10 Marks)
- b. Explain the procedure of calculating the operating capacity and productivity of a bulldozer. (10 Marks)

**OR**

- 10 a. Explain the types of maintenance, state the advantages and disadvantages. (10 Marks)
- b. Discuss about the safety measures adopted in earthmoving equipments. (10 Marks)

\*\*\*\*\*

# CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

18AU742

## Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Operation Research

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

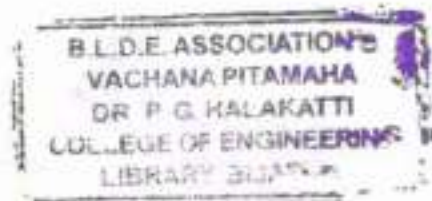
### Module-1

- 1 a. Describe the Operation Research and state its uses. (10 Marks)  
 b. Old hens can be brought at Rs 50 each but young ones cost Rs 100 each. The old hen lay 3 eggs per week while young hens lay 5 eggs per week. Each egg cost Rs 2. A hen costs Rs 5 per week to seed. If a person has only Rs 2000 to spend for hens. Formulate the problem to decide how many of each kind of hen should be buy? Assume that he cannot hold more than 40 hens. (10 Marks)

OR

- 2 a. State the steps involved in Simplex algorithm. (10 Marks)  
 b. By Graphical method, solve the following LPP.

$$\begin{aligned} \text{Max. } Z &= 3x_1 + 4x_2 \\ \text{Subjected to } 5x_1 + 4x_2 &\leq 200 \\ 3x_1 + 5x_2 &\leq 150 \\ 5x_1 + 4x_2 &\geq 100 \\ 8x_1 + 4x_2 &\geq 80 \\ x_1, x_2 &\geq 0. \end{aligned}$$



(10 Marks)

### Module-2

- 3 a. Obtain an initial basic feasible solution to the following transportation problem using the matrix minimize method.

	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply
O <sub>1</sub>	1	2	3	4	6
O <sub>2</sub>	4	3	2	6	8
O <sub>3</sub>	0	2	2	1	10
Demand	4	6	8	6	24

(10 Marks)

- b. Obtain the initial basic feasible solution of a transportation problem using North – West corner rule whose cost and Rim requirement table is given below :

Origin / Destination	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	Supply
O <sub>1</sub>	2	7	4	5
O <sub>2</sub>	3	3	1	8
O <sub>3</sub>	5	4	7	7
O <sub>4</sub>	1	6	2	14
Demand	7	9	18	34

(10 Marks)

OR

- 4 a. Solve the following Assignment problem.

	A	B	C
1	12	11	8
2	8	9	11
3	11	14	12

- b. Differentiate between Transportation problem and Assignment problem.

(10 Marks)  
(10 Marks)

### Module-3

- 5 a. In a Public telephone booth, the arrivals on an average are 15/hour. A call on an average takes 3 minutes. If there is just one phone, find
- The expected number of callers in the booth at any time.
  - The proportion of the time, the booth is expected to be idle.
- b. State the steps involved in the Gomory's cutting plane method for pure IPP problem.

(04 Marks)  
(16 Marks)

### OR

- 6 Explain the components that describe a queuing system.

(20 Marks)

### Module-4

- 7 a. Construct a networks for the project whose activities and precedence relationships are given below

Activity	A	B	C	D	E	F	G	H	I
Immediate predecessor	-	A	A	-	D	BCE	F	D	G,H

- b. Differentiate between PERT and CPM.

(10 Marks)  
(10 Marks)

### OR

- 8 The following table shows the data related to seven activities of a project.

Activity	Preceding Activity	Time		
		$t_a$	$t_m$	$t_p$
A	None	4	6	8
B	A	6	10	14
C	A	8	15	22
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

- Draw a PERT Network for the activity shown in table.
- Prepare the schedule of the 7 activities.
- Find the critical path and mark the path of the Network.
- If a dead line of 47 days for completion of this part of the project, determine the probability that it will be completed in 47 days.

(20 Marks)

**Module-5**

9. A Company has six jobs A to F. All the jobs have to go through two machines M-1 and M-2. The time required for the jobs on each machine is given below. Find the optimum sequence that minimized the total elapsed time.

Job	A	B	C	D	E	F
Machine (1) in hours	1	4	6	3	5	2
Machine (2) in hours	3	6	8	8	1	5

(20 Marks)

OR

10 a. Solve the following game :

$$\begin{matrix} & \text{B} \\ \text{A} & \begin{bmatrix} 4 & -4 \\ -4 & 4 \end{bmatrix} \end{matrix}$$

(10 Marks)

b. Solve the game whose pay Off matrix is given below :

$$\begin{bmatrix} -2 & 0 & 0 & 5 & 3 \\ 3 & 2 & 1 & 2 & 2 \\ -4 & -3 & 0 & -2 & 6 \\ 5 & 3 & -4 & 2 & -6 \end{bmatrix}$$

(10 Marks)

\*\*\*\*\*

USN

--	--	--	--	--	--	--	--

18AU751

## Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Engineering Economics and Cost Estimation

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of interest factor tables is permitted.*

### Module-1

1. a. Define the following economic terms: (10 Marks)
- |                       |                     |                         |
|-----------------------|---------------------|-------------------------|
| (i) Economic goods    | (ii) Utility        | (iii) Value in exchange |
| (iv) Price and wealth | (v) Rent and Profit |                         |
- b. Briefly explain the law of demand and supply. (10 Marks)

OR

2. a. Explain elasticity of demand and supply. What are the factors influencing the elasticity of demand and supply? (10 Marks)
- b. Explain the law of returns and law of substitution with examples. (10 Marks)

### Module-2

3. a. Define money. Explain the functions of money. (10 Marks)
- b. State and explain Gresham's law. What are the limitations of this law? (10 Marks)

OR

4. a. Define principle of taxation. Briefly explain different kinds of taxes. (10 Marks)
- b. Write short notes on: (10 Marks)
- |                        |
|------------------------|
| (i) Value of money     |
| (ii) Vehicle insurance |
| (iii) Index numbers    |

### Module-3

5. a. Explain the interest rate from borrower's and lender's point of view with cash flow diagram. (10 Marks)
- b. A person takes a loan of Rs.10,000 from a HDFC bank at interest of 10% PA. Find the amount if: (10 Marks)
- |   |
|---|
| (i) Interest is compounded annually                       |
| (ii) Interest is compounded half yearly                   |
| (iii) Interest is compounded quarterly                    |
| (iv) Interest is compounded monthly (assume $n = 1$ year) |

OR

6. a. What are the different methods of depreciation charges? Explain any two of them. (10 Marks)
- b. A CNC machine costs Rs.30,00,000 is estimated to serve for 8 years after which its salvage value is estimated to be Rs.2,50,000. Find: (10 Marks)
- |   |
|---|
| (i) Depreciation fund at the end of the 5 <sup>th</sup> year by fixed percentage method                         |
| (ii) Book value of the machine after 4 <sup>th</sup> year and 6 <sup>th</sup> year by declining balance method. |

**Module-4**

- 7 a. Explain the components of cost. (10 Marks)  
 b. A MICO factory produces 500 spark plugs a day involving direct material costs of Rs. 40,000, direct labour cost of Rs.35,000 and factory overhead of Rs.10,000. Assuming a profit of 15% of the selling price and selling overheads to be 30% of the factory cost. Determine the selling price of one spark plug. (10 Marks)

**OR**

- 8 a. A company has three proposals for expanding its business operations. The details are as follows:

Alternative	Initial Cost	Annual Revenue	Life (years)
A <sub>1</sub>	25,00,000	8,00,000	10
A <sub>2</sub>	20,00,000	6,00,000	10
A <sub>3</sub>	30,00,000	10,00,000	10

Each alternative has insignificant salvage value at the end of its life. Assuming an interest rate of 15% compounded annually. Find the best alternative for expanding the business operations of the company using the annual equivalent method. (10 Marks)

- b. The cost of the machine is Rs.6100 and its scrap value is Rs.100. The maintenance cost found from experience are as follows:

Year	1	2	3	4	5	6	7	8
Maintenance cost	100	250	400	600	900	1200	1600	2000

When should the machine replaced?

(10 Marks)

**Module-5**

- 9 a. Define book keeping. Explain the systems of book keeping. (10 Marks)  
 b. Following is the financial status of a company as on 31<sup>st</sup> March 2021.

Sundry debtors	Rs. 10,000
Cash in hand	Rs. 22,000
Bank loans	Rs. 40,000
Bills payable	Rs. 20,000
Equity shares	Rs. 1,13,000
Land and buildings	Rs. 50,000
Plant and machinery	Rs. 90,000
Inventories	Rs. 15,000
Creditors	Rs. 30,000
Bank balance	Rs. 16,000

Prepare a balance sheet as on 31<sup>st</sup> March 2021.

(10 Marks)

**OR**

- 10 a. Define cost estimation. What are the objectives and functions of cost estimation? (10 Marks)  
 b. Explain the different steps involved in estimating procedure. (10 Marks)

\*\*\*\*\*

USN

--	--	--	--	--	--	--	--

## Seventh Semester B.E. Degree Examination, Jan./Feb. 2023 Total Quality Management

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. List out benefits of implementing TQM. (10 Marks)  
b. With a neat diagram, explain framework of TQM. (10 Marks)

**OR**

- 2 a. Explain briefly characteristics of Quality leaders. (10 Marks)  
b. Briefly explain the Customer perception of quality feedback using Customer's complaints. (10 Marks)

### Module-2

- 3 a. Sketch and explain Juran's Trilogy. (10 Marks)  
b. Explain with neat diagram, PDCA cycle for continuous improvement. (10 Marks)

**OR**

- 4 a. Enumerate the Kaizen and six sigma. (10 Marks)  
b. What is FME analysis? Explain the stages in it. (10 Marks)

### Module-3

- 5 a. Explain briefly the Why – why forced field analysis. (10 Marks)  
b. Briefly explain the Affinity diagram and Interrelationship diagram. (10 Marks)

**OR**

- 6 a. Briefly explain the Tree diagram and matrix diagram. (10 Marks)  
b. Discuss briefly the Activity network diagram and Prioritization matrices. (10 Marks)

### Module-4

- 7 a. Write the Scope of Human Resources Management , leading practices. (10 Marks)  
b. Briefly explain Recruitment and Career development. (10 Marks)

**OR**

- 8 a. Briefly explain the Training and Education. (10 Marks)  
b. Discuss the Health , Safety and Employee well being. (10 Marks)

### Module-5

- 9 a. Explain with neat diagram, Paratodiagram. (10 Marks)  
b. Write note on Fish bone diagram and histogram. (10 Marks)

**OR**

- 10 a. With a graph, explain the Scatter diagram. (10 Marks)  
b. Explain briefly Control charts and types of Control charts. (10 Marks)

\*\*\*\*\*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written e.g. 42+8 = 50, will be treated as malpractice.



--	--	--	--	--	--	--	--	--	--

**Seventh Semester B.E. Degree Examination, Jan./Feb. 2023**  
**Automotive Engineering**

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

**Module-1**

- 1 a. Differentiate between spark ignition and compression ignition engines. (08 Marks)
- b. Discuss the air-fuel ratio necessary for SI engine at various operating conditions. (08 Marks)
- c. Define cetane number and octane number of fuel. (04 Marks)

OR

- 2 a. Discuss various abnormal combustion in spark ignition engine. (10 Marks)
- b. With suitable sketch explain actual valve timing diagram for stroke SI engine. (10 Marks)

**Module-2**

- 3 a. With sketch explain forced circulation water cooling system. (06 Marks)
- b. Discuss the adoptability of ethanol in S.I. and biodiesel in C.I. engine. (10 Marks)
- c. Highlight the importance of lubrication. (04 Marks)

OR

- 4 a. Explain thermosiphon cooling system. (05 Marks)
- b. With sketch, explain splash lubrication system. (05 Marks)
- c. With sketch, explain common rail injection system. (10 Marks)

**Module-3**

- 5 a. Discuss the limitation of conventional ignition system. (05 Marks)
- b. Explain the energy requirements for ignition. (05 Marks)
- c. With sketch, explain battery ignition system for Multi Cylinder Engine. (10 Marks)

OR

- 6 a. Discuss the various methods of supercharging. (10 Marks)
- b. Differentiate between naturally aspirated engine and forced induction. (06 Marks)
- c. Explain the terms turbo lag and blow down energy. (04 Marks)

**Module-4**

- 7 a. Discuss the necessity of gear ratio in transmission. (04 Marks)
- b. With sketch explain Single Plate Clutch. (08 Marks)
- c. Explain the operation of antilock braking system. (08 Marks)

OR

- 8 a. Discuss the necessity of clutch in transmission. Highlight the different principle used in clutch operation. (10 Marks)
- b. In detail explain different braking system. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8=50, will be treated as malpractice.

**Module-5**

- 9 a. In detail explain automotive emissions and their source of generation. (10 Marks)  
b. In detail discuss the various aspects of catalytic converter and its use to reduce HC, CO and NO<sub>x</sub> emissions in IC engine. (10 Marks)

**OR**

- 10 a. Relate the HC, CO and NO<sub>x</sub> emission level to air-fuel ratio used in various engine operating conditions. (10 Marks)  
b. Discuss the effect of exhaust gas recirculation on emission and engine performance. (05 Marks)  
c. Discuss the ill-effect of automotive emission on environment. (05 Marks)

\*\*\*\*\*